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SPSPro

OPERATION MANUAL

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1 OVERVIEW

SPSPro is a software program which runs on the Microsoft Windows operating system, designed to allow the user to QC, analyse and manage Shell Processing Support (SPS) files used to record land and OBC seismic survey positioning data. The installation and licensing of this program is documented separately from this manual.

The SPS dataset need not contain any header records. If header records are present then certain features of the program will make use of this.

Note: When using header records the program assumes all headers found in the entire dataset are identical, and will read only the first header found.



1.1 Projects

A project is a set of parameters defining all of the file locations and program parameters. This information is stored in a Project File with the extension “prj”. When the software is initially installed, the default Project File is “SPSPro.prj”, located in the program folder.

1.1.1 Creating and Opening a Project

A project is created by first saving the current project as a new project by choosing *File | Save Project As* from the main menu, and then changing the setup parameters (see Setup).

To open a previously saved project choose *File | Open Project* from the main menu.

1.2 Main Toolbar

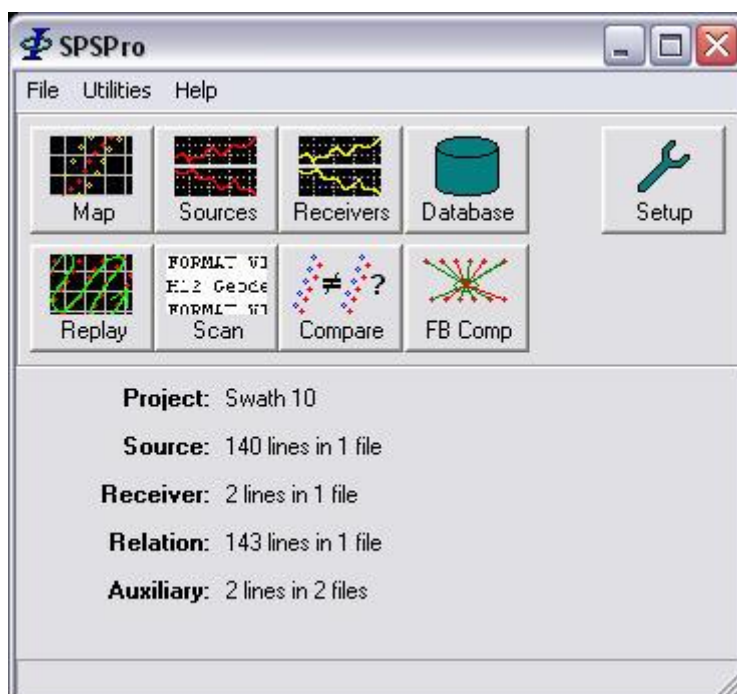


Figure 1-1



Displays interactive map of the SPS file set for the selected display type.



Displays interactive time series plots of selected source attributes.



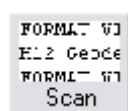
Displays interactive time series plots of selected receiver attributes.



Used to manage files and display and edit data. Also provides functions for data interpolation.



Replays the SPS file set as acquired.



Performs format and integrity checking.



Compares the Source or Receiver data from a single line in the current file set with corresponding data from another file.



Starts the receiver coordinate computation module.



Invokes the Setup dialog to allow entry or changes to all program parameters.



1.3 Main Menu

1.3.1 File

- New Project:** Create a new project.
- Open Project:** Dialog to open a previously saved project definition file.
- Save Project As:** Dialog to copy the current project definition file.
- Recent Projects:** Lists the last 8 opened projects for quick re-opening.
- Station Logging:** Toggles interactive logging to text file of stations plotted on the map.
- Open Station Log:** Opens the station log file, if recorded.
- Printer Setup:** Invokes the Printer Setup dialog.
- Remove Licence:** Invokes dialog to removes the user licence at termination of contract.
- Update Licence:** Invokes dialog to extends the user licence.
- Exit:** Exits the program.

1.3.2 Utilities

- Attach Header:** Dialog to select a header file to attach to the beginning of all SPS files in the project.
- Remove Headers:** Removes the header from all SPS files in the project.
- Unix to DOS:** Converts all files in the project to DOS format (each record terminated with carriage return and line feed characters).
- Export Shape:** Used to convert selected files into ESRI Shape format.
- SPS to P1/90:** Converts selected SPS files into UKOOA P1/90 format.
- P1/90 to SPS:** Converts selected UKOOA P1/90 files into SPS format.
- Split by Line:** Splits selected SPS files into their constituent lines. For each unique line name found in a consecutive block of records a separate SPS file named by the line name is produced. Duplicate lines are written to a file whose name contains an incremental number.
- Edit with CGG list:** Enables use of the CGG proprietary SPS exclusion list to either delete or apply KL codes to records specified in the list.

1.3.3 Help

- Manual:** Opens the user manual.
- About:** Displays the program version, licence number, number of days remaining for the licence and technical support contact details.
-



2 SETUP

Click on the *Setup* button on the main toolbar to display or edit the current Project parameters.

When changes are made to any of the parameters described in this section, click on the *Apply* button to apply the *whole* parameter set to the SPS dataset. Click on the *Cancel* button to discard all changes and revert to the initial parameter set.

2.1 Files

The SPS dataset comprising source, receiver and relational files are specified in the *Source*, *Receiver* and *Relation* pages of the Setup window, as shown below in Figure 2-1. An additional set, *Auxiliary*, can be used for any type of SPS files. Each page has identical functionality.

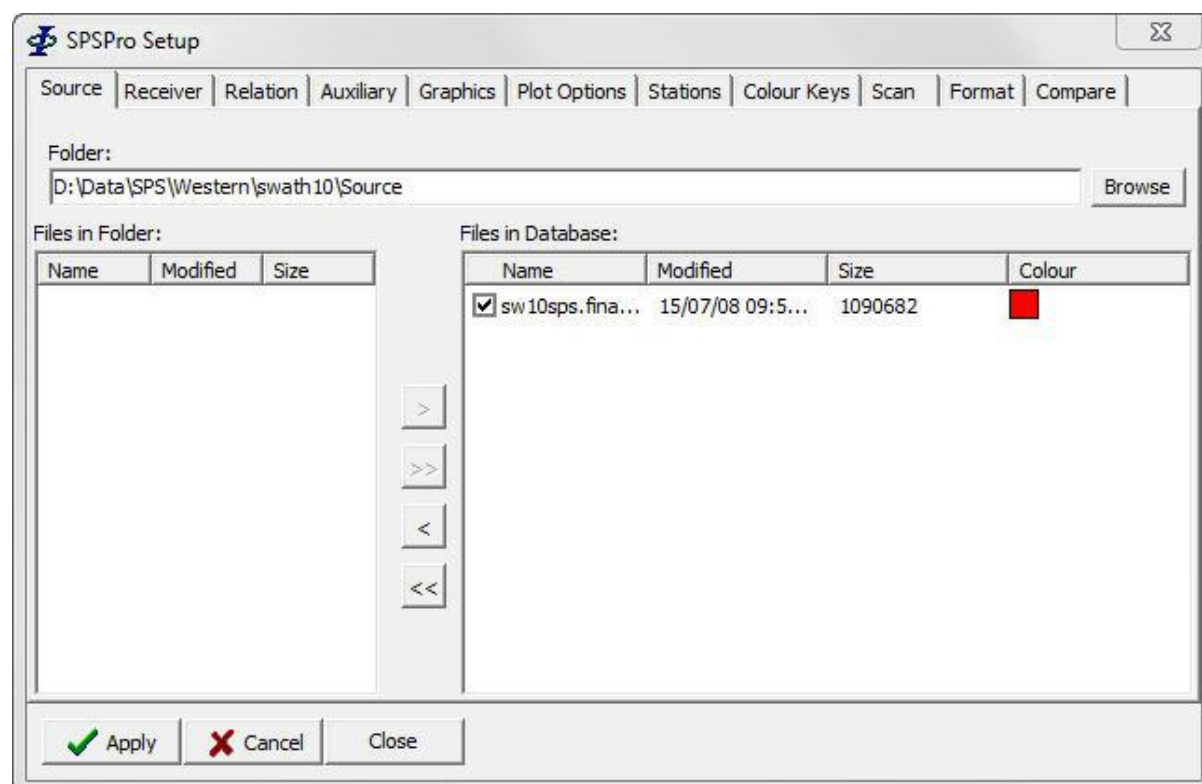


Figure 2-1

Enter, or browse for, the folder which contains the files required. All files in the folder, including non-SPS files, will be listed. Those which have previously been selected for inclusion in the database appear in the right list (*Database* list) and all remaining files appear in the left list (*Folder* list).



Files may be moved between the lists by either double clicking on the filename or using the arrow buttons.

Each list is initially sorted by file name. Clicking on the column headers will change the sort method to the attribute in the column title. Consecutive clicks on the same column header will toggle the sort between first-last and last-first.

2.1.1 SPS Format

The software will attempt to automatically detect which SPS format revision (1.0 or 2.1) in which input files are recorded. If it is unable to so (e.g. there is no file header) then the user will be prompted to enter the format revision.

Important: without the correct format revision specified unexpected results will be seen throughout..

2.1.2 Viewing/Editing Files

A file may be opened for viewing/editing by right clicking on the file name and selecting *Edit* from the popup menu.

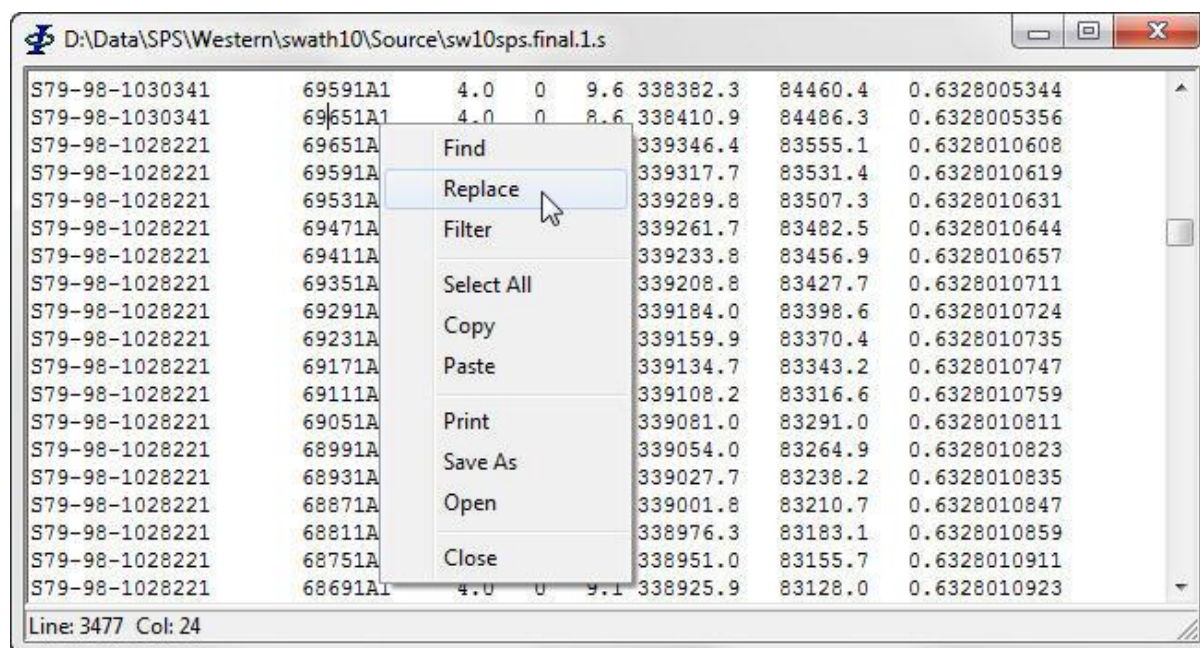


Figure 2-2

Standard file and text editing functions are available from the popup menu invoked by right clicking on the window, as shown above in Figure 2-2.



When the file is saved it is automatically re-read into the database if included in the dataset.

2.1.3 Display Attributes

Each file can be plotted in its specified colour. The default colour when selecting new files is that specified under *Setup | Stations | Colours*. This colour may be overridden by clicking on the file's colour box.

Set the colour and visibility from the popup menu by right clicking on the selected file(s).

2.2 Graphics

Graphics files in DXF and ESRI Shape format may be displayed on the map. Click the *Add Files* button to add files.

Set the colour and visibility from the popup menu by right clicking on the selected file(s).



2.3 Plot Options

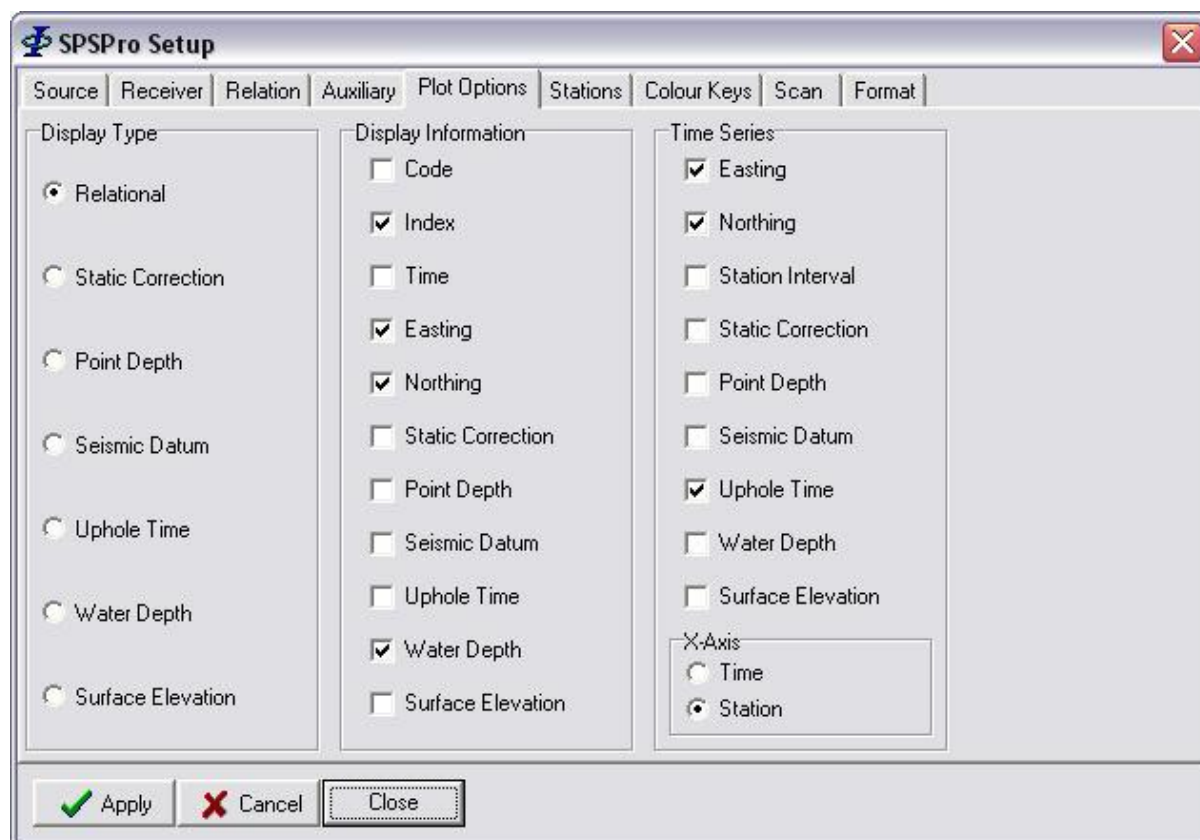


Figure 2-3

2.3.1 Display Type

The *Display Type* group is used to specify what is displayed on the interactive map.

When set to *Relational* the sources and receivers are plotted using the colours specified in the *Stations* page of the Setup module (see *Colour Keys*). This setting allows interactive visualisation of the active receivers for each source, as well as acquisition replay.

Selecting any one of the remaining attributes will map the sources and receivers using the colour legend as specified in the *Colour Keys* page of the Setup module.

2.3.2 Display Information

The *Display Information* group is used to specify which attribute values are displayed in the *Information* panel of the interactive map when the mouse cursor is positioned over a source or receiver station.



Only four attributes can be selected for simultaneous display. To change the selection first de-select the unwanted attributes before selecting those required.

2.3.3 Time Series

The *Time Series* group is used to specify which attributes are to be included as series in the time series plots. Up to five attributes can be selected for simultaneous plotting.

The *X-Axis* selection is used to specify the abscissa scale of the plots:

Time: The values range from the minimum to the maximum time, at equal time intervals. This option is best used to QC the positioning of a gun vessel or dynamically laid receivers.

Station: The values range from the minimum to the maximum station number, at equal number intervals. This option is best used to QC receiver group intervals.



2.4 Stations

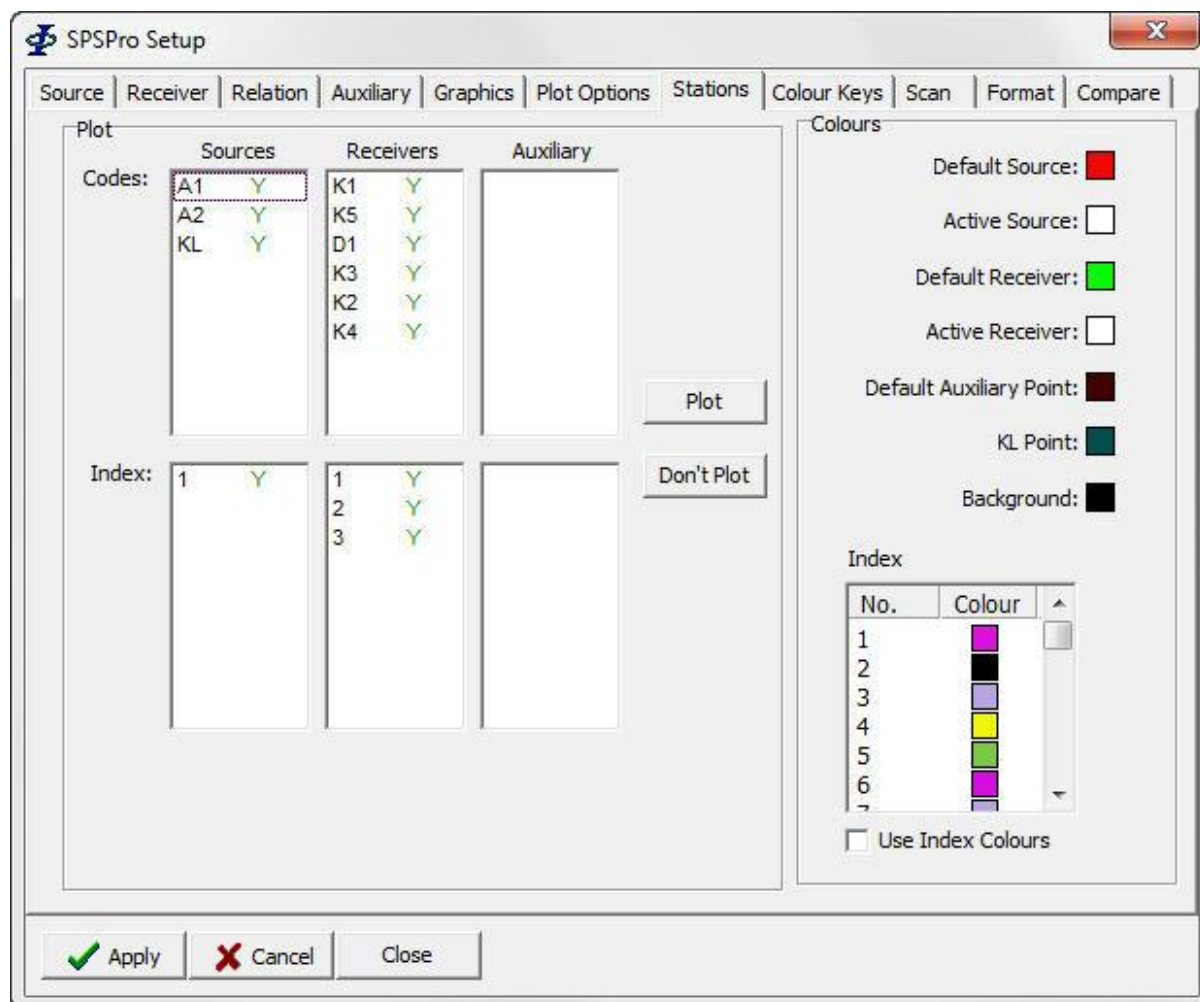


Figure 2-4

2.4.1 Codes and Indices

The code and index lists are populated from those found in the data records.

2.4.2 Plot

The *Plot* group allows the user to specify which stations are to be plotted on both the map display and the time series plots based on instrument code and station index.

To change the plot status for either of these attributes highlight the required attributes in any of the lists and then click on the *Plot* button or *Don't Plot* button.



2.4.3 Colours

The *Colours* group allows the user to specify which colours to use for plotting the stations on the map display and for specifying the map background colour.

To change any colour click on the colour key with the left mouse button and select the new colour from the colour dialog.

Colours may be copied and pasted by right clicking on the colour key and selecting from the respective options in the popup menu.



2.5 Colour Keys

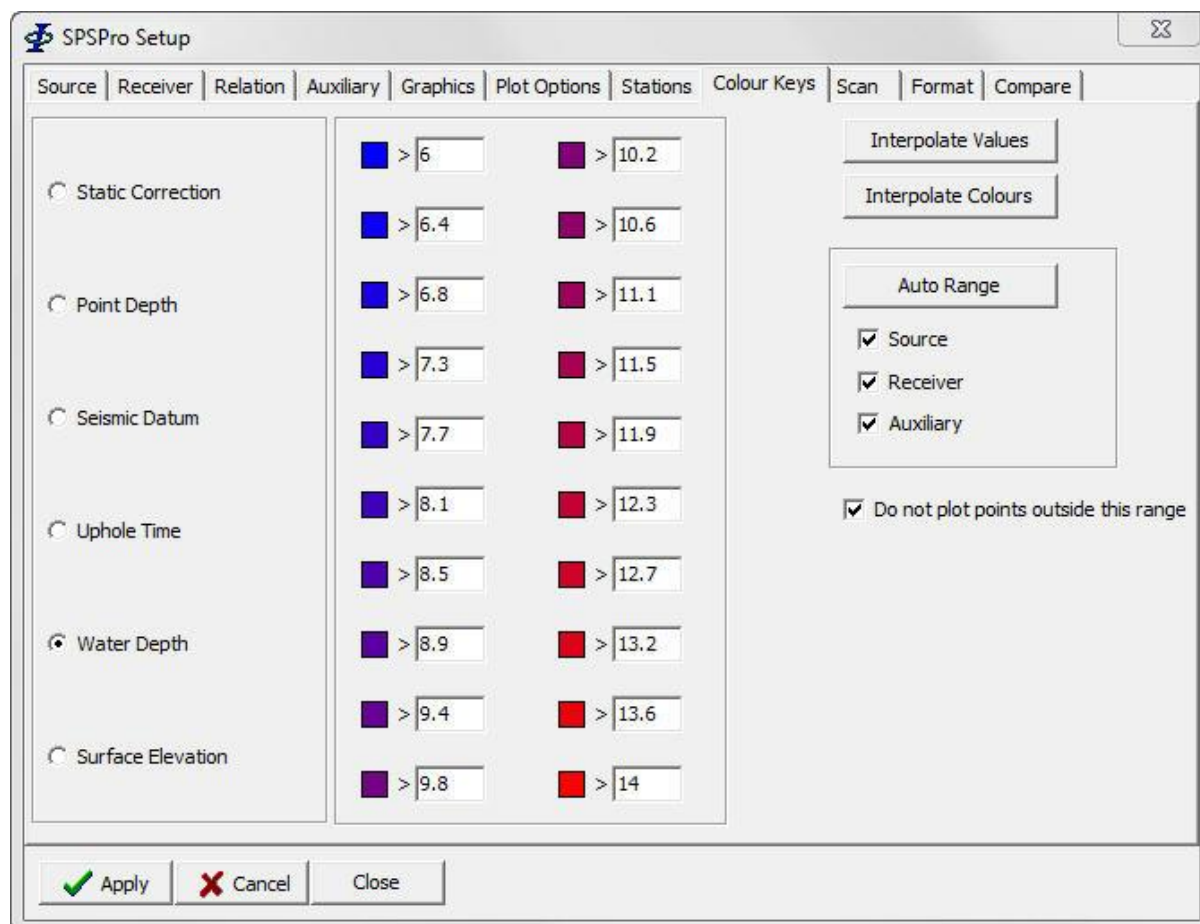


Figure 2-5

The *Colour Keys* page allows the user to specify the colours and corresponding values for attribute mapping (see Display Type).

The points whose attribute value is *greater than* the key value will be plotted in the corresponding colour.

To change any colour click on the colour key with the left mouse button and select the new colour from the colour dialog.

Colours may be copied and pasted by right clicking on the colour key and selecting from the respective options in the popup menu.



2.5.1 *Auto Fill*

To automatically set the values, enter the first and last values then click the *Auto Fill Values* button. The remaining values will be interpolated.

To automatically set the colours, set the first and last colours then click the *Auto Fill Colours* button. The remaining colours will be interpolated.

2.5.2 *Auto Range*

To set the range and value interpolation to match the maximum and minimum values found in the dataset click the *Auto Range* button. Auto ranges will be applied to the selected categories – source, receiver and auxiliary.

2.5.3 *Outside Range*

To suppress plotting of points whose value falls outside the specified maximum and minimum values check the *Do not plot...* checkbox.

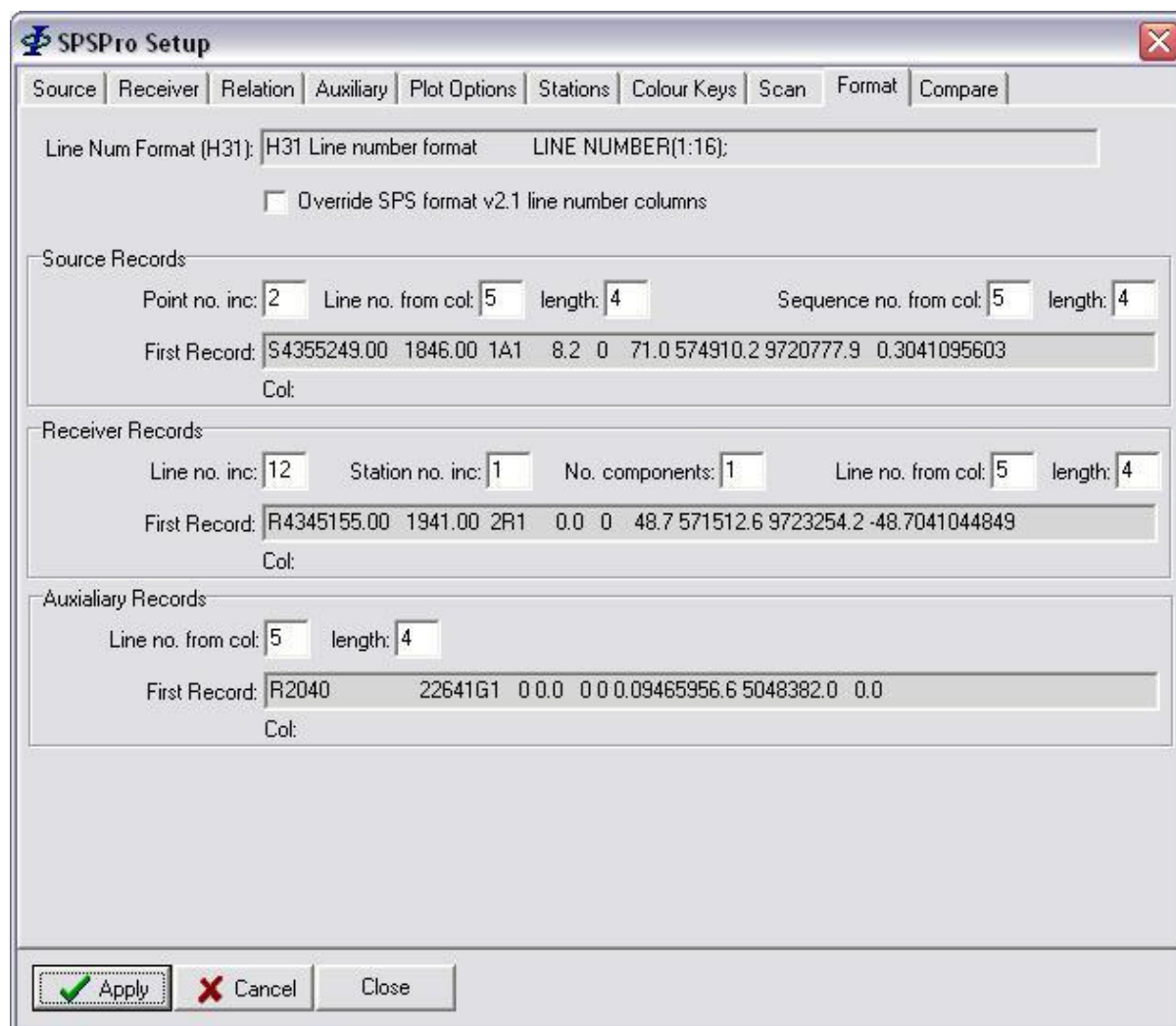


2.6 Scan

See section 7.



2.7 Format



The SPSPro Setup dialog box is shown with the 'Format' tab selected. The 'Line Num Format (H31):' field is set to 'H31 Line number format' and 'LINE NUMBER(1:16);'. The 'Override SPS format v2.1 line number columns' checkbox is unchecked. The 'Source Records' section shows 'Point no. inc:' as 2, 'Line no. from col:' as 5, 'length:' as 4, and 'Sequence no. from col:' as 5, 'length:' as 4. The 'First Record:' field displays a sample record: 'S4355249.00 1846.00 1A1 8.2 0 71.0 574910.2 9720777.9 0.3041095603'. The 'Receiver Records' section shows 'Line no. inc:' as 12, 'Station no. inc:' as 1, 'No. components:' as 1, and 'Line no. from col:' as 5, 'length:' as 4. The 'First Record:' field displays a sample record: 'R4345155.00 1941.00 2R1 0.0 0 48.7 571512.6 9723254.2 -48.7041044849'. The 'Auxiliary Records' section shows 'Line no. from col:' as 5, 'length:' as 4. The 'First Record:' field displays a sample record: 'R2040 22641G1 0 0.0 0 0.09465956.6 5048382.0 0.0'. The 'Col:' field is empty for all sections. The 'Apply' button is highlighted with a green checkmark, and the 'Cancel' button is highlighted with a red X.

Figure 2-6

The *Format* page is used to specify how the data records are parsed. **The parameters are not optional, except where indicated below**, and need to be correctly entered in order for the program to perform correctly in all respects.

The format parameters are split into three groups as described below.

As an aid the H31 record (SPS format revision 1 only) in the first header found in the SPS dataset is displayed.

Additionally, first Source, Receiver and Auxiliary data records found in the SPS dataset are



displayed in the *First Record* fields of their respective parameter groups. When the cursor is placed in these fields the cursor column position is displayed directly below the field.

2.7.1 Source Records

Point Number Increment: Enter the expected shotpoint numbering increment.
Sequence No: Enter the starting column and number of characters (field length) used for the line sequence number. This may be left blank.

2.7.2 Receiver Records

Line Number Increment: Enter the expected receiver line numbering increment.
Station Number Increment: Enter the expected receiver station numbering increment.
Line No: Enter the starting column and number of characters (field length) used for the receiver line number. Optional for SPS format rev. 2.1.

The line numbering increment and station numbering increment are specified for use in scanning the receiver file to report any exceptions in the ordering of the records. (Receiver records should be ordered by line number, point number and index number).

2.7.3 Auxiliary Records

Line No: Enter the starting column and number of characters (field length) used for the line number. This could be a receiver line or a source line depending on which file type has been selected for the auxiliary dataset. Optional for SPS format rev. 2.1.

2.7.4 Relation Records

For SPS format rev. 1 the line number positions within the line name are expected to be the same as in the source and receiver records, therefore no further parameters are required.

2.7.5 Override

There may be a case when using SPS format revision 2.1 files that the line numbering does not conform to the rev 2.1 format. For this reason the option is provided to override the SPS format rev. 2.1 line numbering format by checking the *Override...* checkbox. When this is checked the specified line number columns will be used.

2.8 Compare

Refer to section 6 Compare.



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3 MAP

Click on the *Map* button on the main toolbar to display a map of the selected attribute as specified in the *Setup | Plot Options | Display Type*.

Sources are plotted as crosses, receivers as circles and auxiliary points as squares.

The information shown in the panel to the left of the map pertains to the source and/or receiver at the current cursor position. The information given is the line name, point number and the attributes specified in *Setup | Plot Options | Display Information*.

The Grid coordinates of the mouse cursor position are displayed in the lower left panel.

To make distance and azimuth measurements on the map drag the mouse between the required points keeping the right mouse button depressed. The distance, delta east and north, and azimuth are displayed in the lower left panel.

To zoom in around an area use the left mouse button to define a rectangle. To zoom in or out centred at the mouse location use the mouse wheel.



3.1 Toolbar



Close the display.



Send the display to the default printer.



Save the display as a Windows bitmap file (.bmp).



Scale both axes the same.



When down, the mouse can be used to highlight the active spread by clicking on a source point.



Enable mouse panning.



Enable window zoom.



Zoom in.



Zoom out.



Zoom extents.



Toggle source display on/off.



Toggle receiver display on/off.



Toggle auxiliary display on/off.



Plot source station numbers.



Plot receiver station numbers.



Plot auxiliary station numbers.



Toggles display of imported DXF files (see **Error! Reference source not found.**)



Toggles display of imported Shape files (see **Error! Reference source not found.**)



Display hint window with selected attribute values when mouse over point.



Connect stations as a visual aid.



Enables a station position to be edited by dragging the point using the left mouse button.



When plotting water depths, toggles application of tidal reductions stored as the Surface Elevation attribute. When invoked, water depths displayed in the information panel on the left and the hint window are the reduced depths.



3.2 Logging

SPSPro allows logging of selected points on the map to a file. File types supported are comma separated value (.csv), tab delimited (.txt) and space delimited (.txt).

From the Main Menu select *File | Station Logging*. In the dialog select the file type. Select an existing log file or enter the name of a new log file. Click *Open*.

The menu item will be checked and the log file name and path will be displayed in the status bar of the main window. If the file already exists any new points logged will be appended to the file.

Click on *Map* in the main toolbar. As long as logging is enabled by clicking on a source or receiver on the map that point's position and all attributes will be written to the log file with each field separated by a comma, and the record terminated by a carriage return/line feed. The Windows Default Beep will play when a point is logged.

To stop logging and close the log file select *File | Station Logging* again. This menu item will then be unchecked.

3.3 Kill Point

A *KL* code can be applied to a point by right clicking on the point with the mouse and selecting *Kill Point* from the pop-up menu. To resurrect a point select *Un-kill Point* from the pop-up menu.



3.4 Relational Map

Under *Setup | Plot Options | Display Type* | select the *Relational* option, then click on the *Map* button.

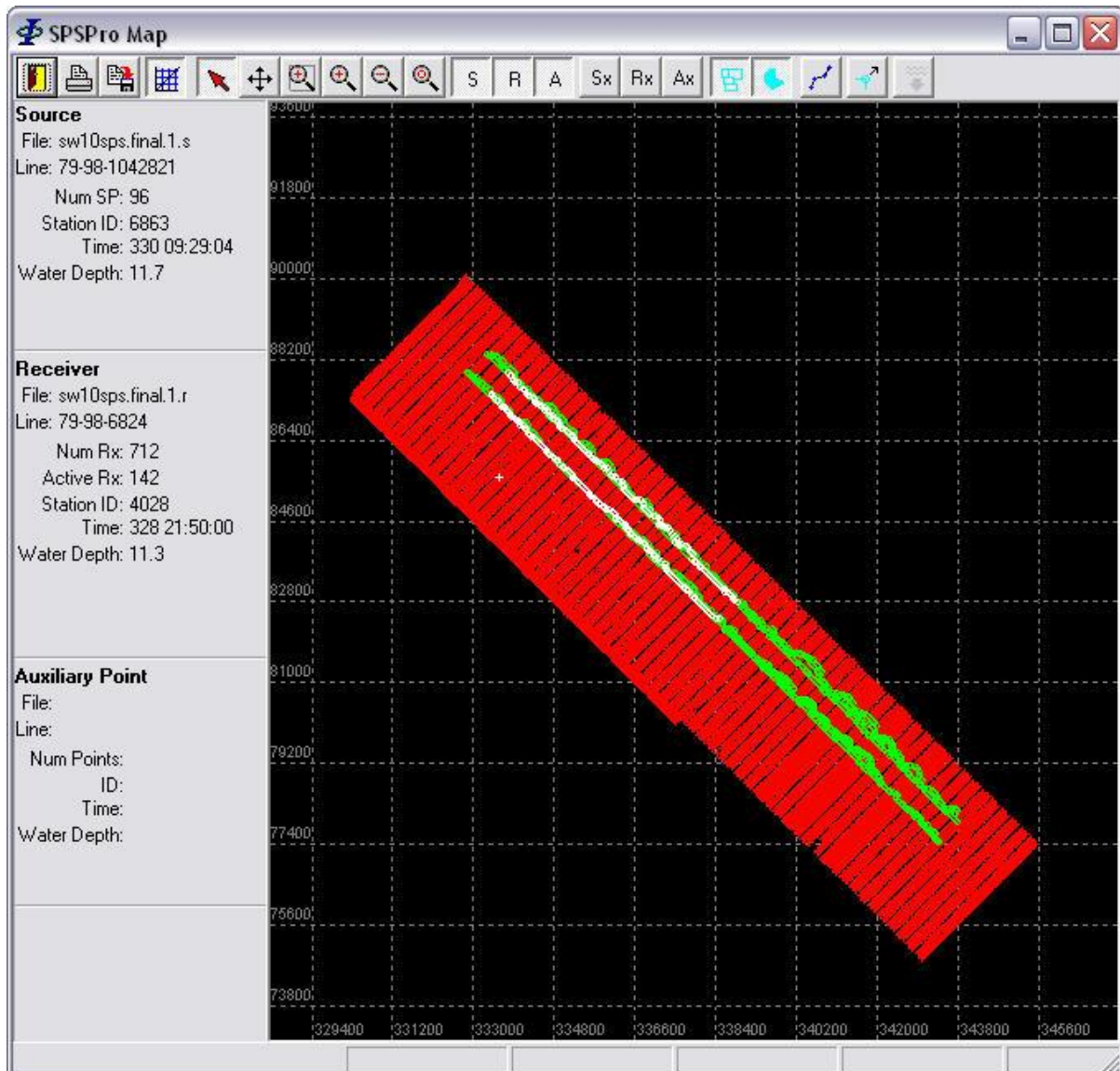


Figure 3-1

The relational map allows visualisation of the active spread into which a shot is fired. Sources and receivers are plotted in the colours specified in *Setup | Stations | Colours*.

To highlight the active receivers, with the  button down, click on any source point with



the left mouse button. Receivers flagged as active for that shot in the relation file will be plotted in the Active Receiver colour.

When the mouse cursor is positioned over a receiver the number of active receivers in that line is displayed in the *Receiver* panel.



3.5 Attribute Map

Under *Setup | Plot Options | Display* | select one of the attributes, then click on the *Map* button.

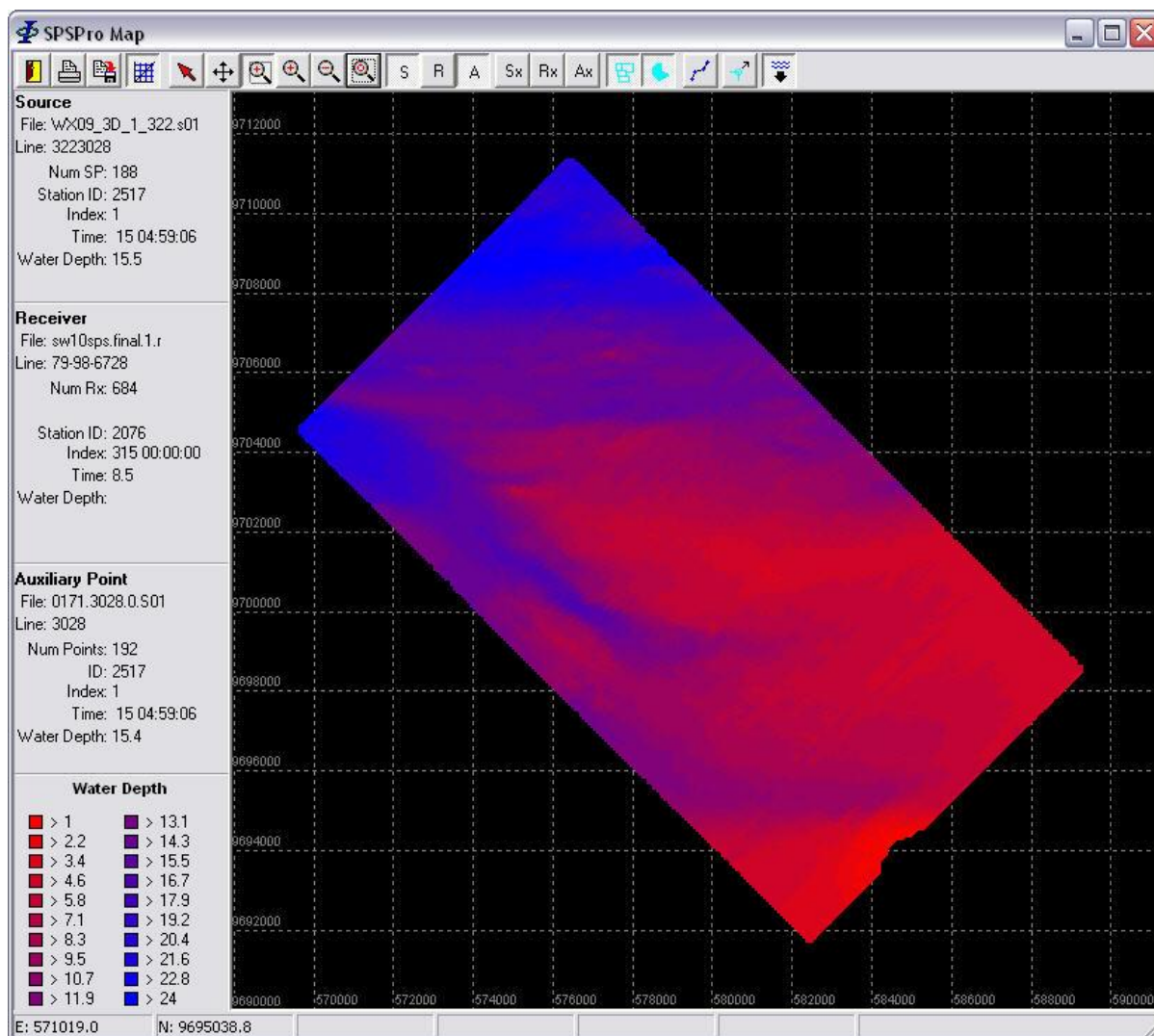


Figure 3-2

The attribute map displays values from the selected attribute colour coded according to the colour key settings for that attribute specified in *Setup | Colour Keys*.

Any one of the following attributes can be mapped provided the data is present in the SPS data file:

Static Correction



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Point Depth
Seismic Datum
Uphole Time
Water depth
Surface Elevation



4 REPLAY

Under *Setup | Plot Options | Display* | select the *Relational* option. On the main toolbar click on the *Replay* button. The replay toolbar shown below in Figure 4-1 appears.

Replay replays the swath as it was acquired, displaying the active spread for each shot, provided that the Source and Relation records are sorted chronologically as is required by the SPS format.

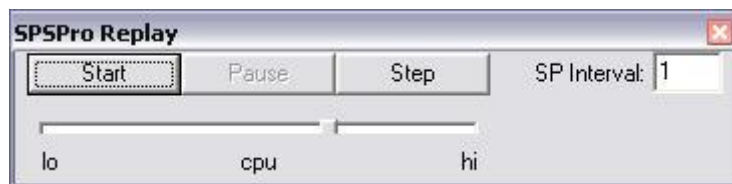


Figure 4-1

- Start:* Start replay. This button then changes to the *Stop* button.
Pause: Pauses replay.
Step: Replays the next shot.
SP Interval: Replays only every *n*th shot where *n* is the specified interval.
Cpu: Controls the CPU priority when other applications are running.

Click on the *Start* button or *Step* button to commence replay.

The speed of replay can be increased by increasing the SP interval.

The active source's selected attributes are displayed in the left panel.

Once replayed, sources are plotted in grey as shown below in Figure 4-2.

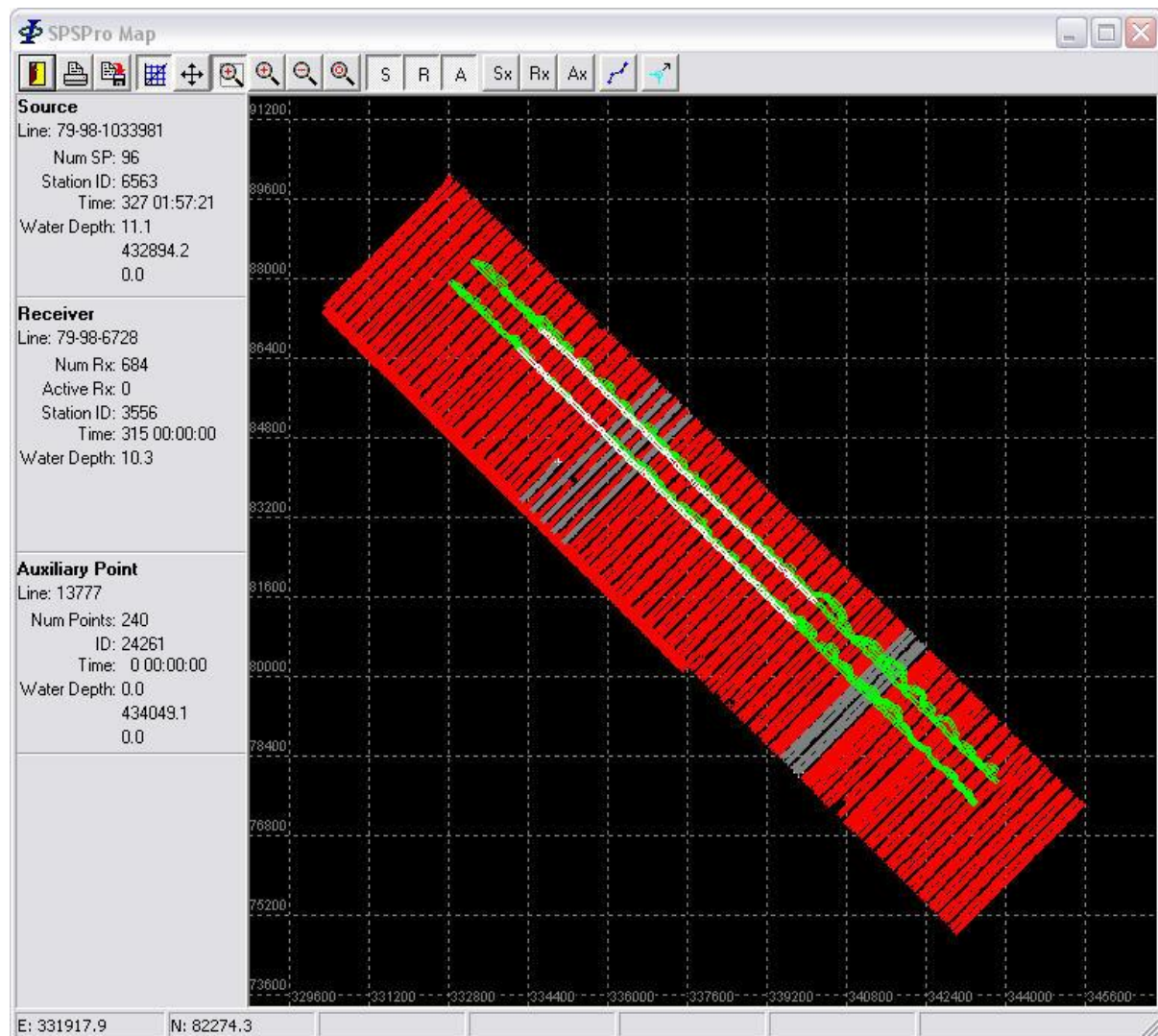


Figure 4-2



5 TIME SERIES PLOTS

To display interactive time series plots of the specified attributes for sources or receivers click on the *Plot Srcs* or *Plot Rcvrs* button respectively.

For each source or receiver line up to five attributes may be selected from *Setup | Plot Options | Time Series*. Each of these attributes will appear as a separate series in the time series plots.

Stations whose instrument codes and indices are selected for plotting in *Setup | Stations | Plot* will be plotted. Each source or receiver line will appear in a separate graph.

See **Error! Reference source not found.** below for a detailed description of the time series plotting module. The Multiplot module is common to all FGPS software and the example illustrations provided may not necessarily pertain to the SPSPro program.

Note: When plotting receiver lines which have been laid in more than one run set the X-axis to *Station* under *Setup | Plot Options | Time Series*.



6 COMPARE

The *Compare* module enables the comparison of selected attributes between SPS files. These files may be part of the database for the current project, or they may be external files.

6.1 Setup

Before the comparison can be carried out the comparison parameters must be established in the main *Setup* module, *Compare* page, shown in Figure 6-1 below.

The screenshot shows the 'SPSPro Setup' window with the 'Compare' tab selected. The window has a tabbed interface with tabs for Source, Receiver, Relation, Auxiliary, Graphics, Plot Options, Stations, Colour Keys, Scan, Format, and Compare. The 'Compare' tab contains the following elements:

- Dataset 1:** A 'Folder:' text box with a 'Browse' button. Below it, 'Point index:' is set to 'Do not use' (dropdown), 'Line no. from col:' is '9' (text box), and 'length:' is '4' (text box).
- Dataset 2:** Similar to Dataset 1, with 'Folder:', 'Point index:' (Do not use), 'Line no. from col:' (9), and 'length:' (4).
- Comparison Options:** A list of checkboxes for attributes to compare:
 - ☒ Radial
 - ☒ Across
 - ☒ Along
 - ☐ Bearing
 - ☐ Static Correction
 - ☐ Point Depth
 - ☐ Seismic Datum
 - ☐ Uphole Time
 - ☐ Water Depth
 - ☐ Surface Elevation
- Report % samples >=**: A numeric input field with a value of 10.0, and two buttons '>' and '<' for adjusting the threshold. Below the input field are the values 5.0 and 2.0.
- Match instrument codes:** A checkbox that is currently unchecked.
- Point matching:** A dropdown menu set to 'Auto'.
- Report Folder:** A text box containing 'D:\Data\SPS\Western\swath10\Reports' and a 'Browse' button.
- Buttons:** At the bottom are 'Apply' (with a green checkmark icon), 'Cancel' (with a red X icon), and 'Close' buttons.

Figure 6-1

6.1.1 External Dataset Parameters

The *Dataset 1* and *Dataset 2* parameters refer to the two sets of files being compared. The



parameters for each are described below:

- Folder:** Select the default folder where external files are located. Applicable only to files external to the current project's database.
- Line No. From Col and Length:** Set the start column and number of characters where the number is written in the records. Applicable only to files external to the current project's database. This is optional for files recorded in SPS format revision 2.1. To apply the specified line number column positions to these files the *Override...* checkbox in the *Format* setup page must be checked.

6.1.2 Point Index

Select the index number of the points to be compared. By selecting a different index for each file set it is possible to compare points with different indices.

6.1.3 Attributes

For each attribute for which the comparison is required, check the relevant checkbox..

6.1.4 Statistics

Optionally specify up to ten thresholds above which it is required to report the number of difference samples for the selected attribute by entering a value and clicking the > button or pressing <Enter>. Click the < button to remove selected criteria.

6.1.5 Instrument Codes

By checking the *Match instrument codes* checkbox, comparisons will only be made between records with the same instrument code. This is useful when comparing source files with flip-flopping source.

6.1.6 Point Matching

- Auto:** matching will be performed by station ID for receiver data and shot time for source data.
- ID:** matching will be performed by point ID.
- Time:** matching will be performed by point time.

6.1.7 Report

Optionally specify or browse for the name of the report folder to which the comparison reports are to be written.



Click *Apply* when finished.

6.2 File Selection

In the main program window click the *Compare* button to display the *Compare* module, shown in Figure 6-2 below.

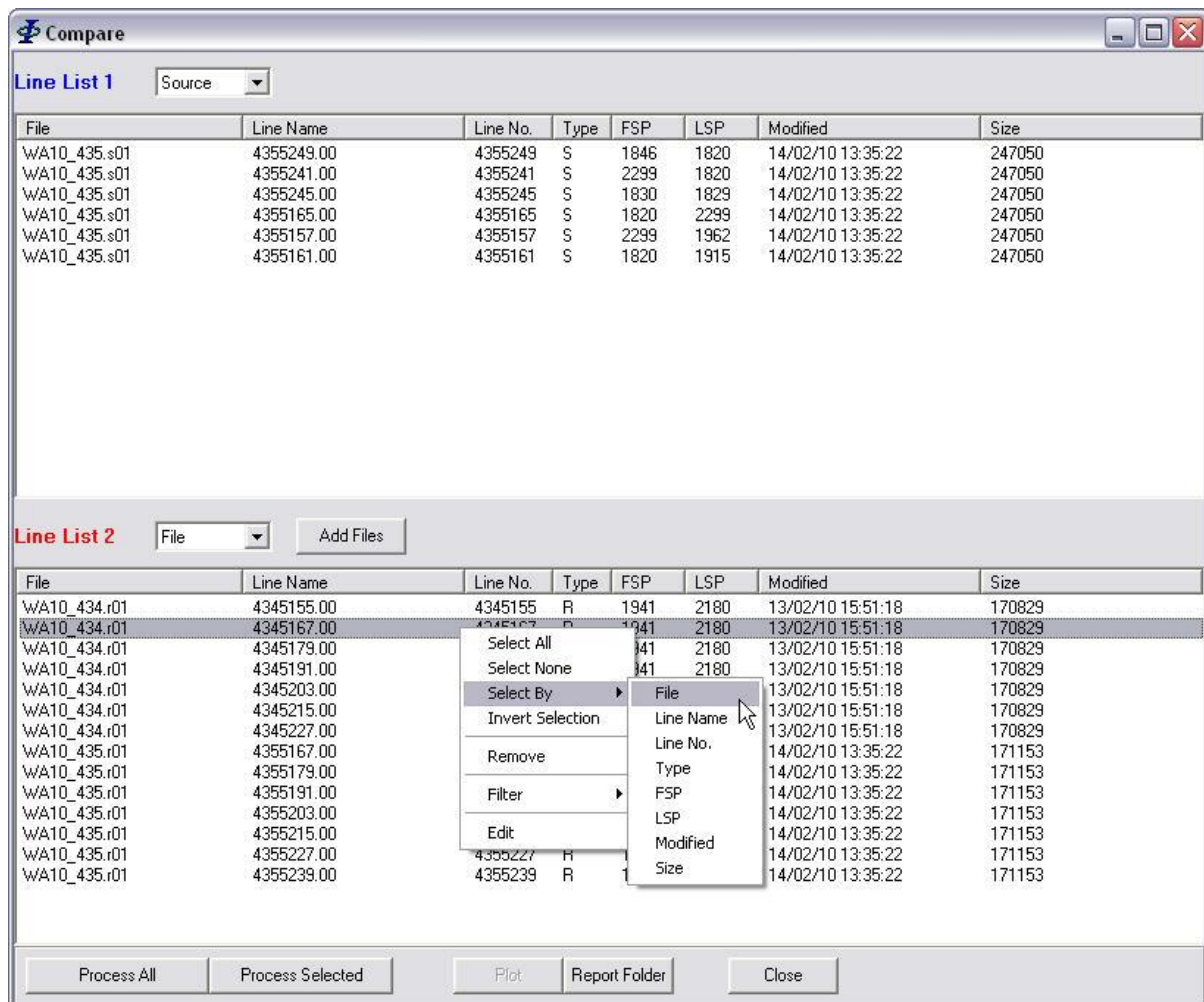


Figure 6-2

Two line lists are shown and each have identical functionality. The lines in list 1 will be compared to the lines in list 2. For each list select from the dropdown list which files to be compared. The options are:

File: For selecting files external to those in the current project's database. Click the *Add Files* button and select multiple files from the dialog.



Files containing multiple lines will be split into their constituent lines, with a new entry made in the list for each line.

Source: All lines in the *Source* category will be selected.

Receiver: All lines in the *Receiver* category will be selected.

Auxiliary: All lines in the *Auxiliary* category will be selected.

Important: the comparison is based on matching line numbers therefore the *Line No.* attribute for each entry should be verified, and if incorrect the appropriate line number column settings should be changed in either the *Format* or *Compare* pages of the *Setup* module.

Each line list can be modified using the functions accessible from the popup menu by right clicking on the list. These functions are described below:

Select All: All lines will be selected.

Select None: No lines will be selected.

Select By: From the sub-menu select which attribute to filter and enter a filter string. All lines whose selected attribute contains the specified filter string will be selected.

Invert Selection: Inverts the current selection.

Remove: Removes the selected lines from the list. This can also be done by pressing the <Delete> button on the keyboard.

Filter: From the sub-menu select which attribute to filter and enter a filter string. All lines whose selected attribute does not contain the specified filter string will be removed.

Edit: Displays the contents of the selected file for viewing/editing. Does not apply to multiple selections.

Note: selections in each list are mutually exclusive i.e. selecting lines in one list will remove the selection in the other list.

6.3 Process

Process All: for each line in the **top** list the program will search for all lines in the bottom list with a matching line number.



Process Selected: For each selected line the program will search for all lines in the **other** list with a matching line number. A comparison will be run on the matching lines.

A comparison will be run on the matching lines. All record attributes as specified under *Setup | Compare* will be compared.

6.4 Reports

6.4.1 Text Report

A text report providing the summarised comparison statistics for each comparison will be displayed on completion of the process. This report is not saved to disk until the user saves it by selecting *Save As* from the report popup menu. An example of this report is shown below in Figure 6-3.

6.4.2 Summary Report

A summary report in comma separated value (CSV) format is written to the folder specified under *Setup | Compare*. The file name is "compare_summary.csv". An example of this report is shown below in Figure 6-4.

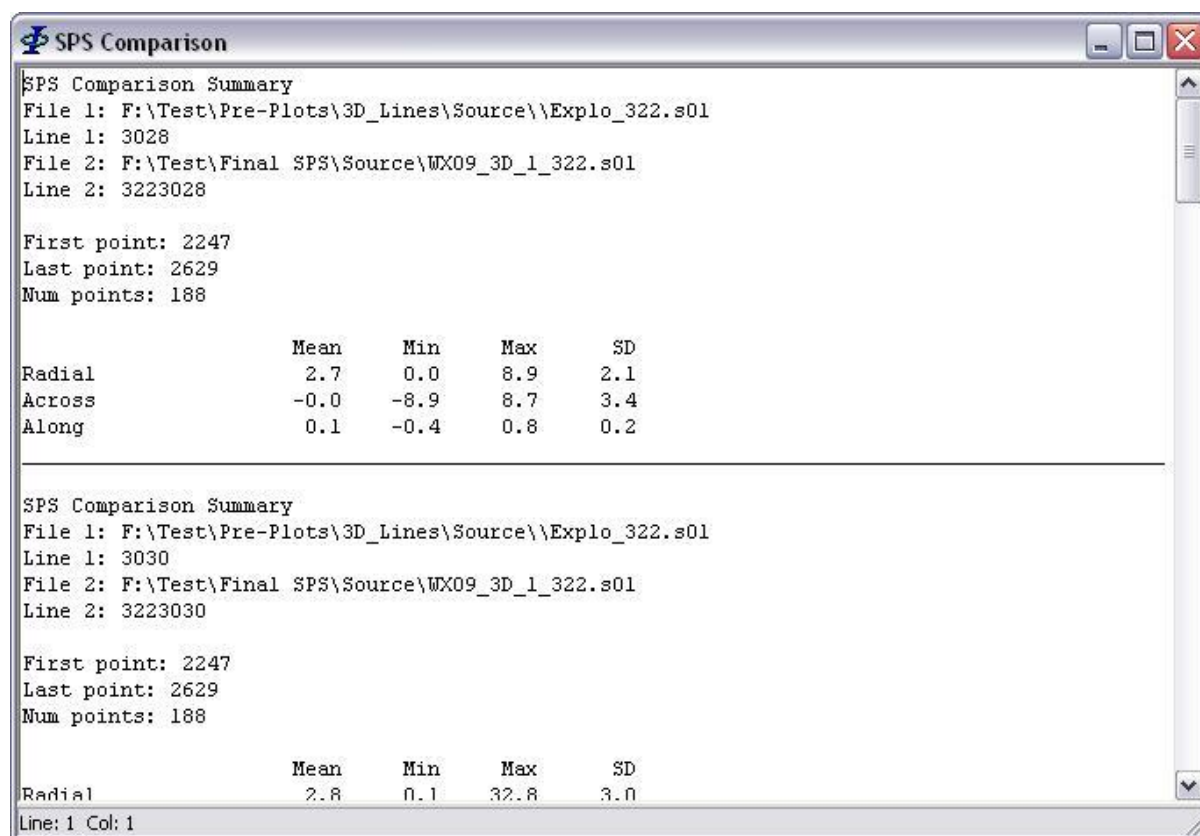


Figure 6-3

File1	File2	Line	FSP	LSP	Radial			Across			Along		
					Mean	Max	Min	Mean	Max	Min	Mean	Max	Min
WX09_3D	Explo_322	3223028	2629	2247	2.7	8.9	0.0	0.0	8.9	-8.7	-0.1	0.4	-0.8
WX09_3D	Explo_322	3223030	2247	2629	2.8	32.8	0.1	0.8	9.9	-32.8	0.0	0.9	-0.6
WX09_3D	Explo_322	3223032	2629	2247	3.1	12.1	0.1	-0.6	12.1	-10.9	0.1	1.0	-1.7
WX09_3D	Explo_322	3223034	2247	2629	2.7	8.8	0.1	-1.8	4.6	-8.8	0.0	0.6	-0.6
WX09_3D	Explo_322	3223036	2629	2247	4.2	14.8	0.2	-1.8	14.7	-13.7	0.1	1.8	-0.8
WX09_3D	Explo_322	3223038	2247	2629	3.0	18.2	0.1	-0.5	7.1	-18.2	-0.1	1.1	-1.7

Figure 6-4

6.4.3 Detail Report

The value of each point compared is written to a CSV file located in folder specified under *Setup | Compare*. The file name is in the format:



<file 1>-<file 2>_<line name>.comp.csv.

An example of this file is shown below in Figure 6-5.

Code	Line	Shot	Radial	Across	Along	Water Depth
A1	3223028	2629	0.6	0.6	-0.3	0.1
A1	3223028	2627	0.8	-0.8	0.2	0.0
A1	3223028	2625	1.0	-0.9	0.5	0.0
A1	3223028	2623	0.4	0.4	0.0	-0.1
A1	3223028	2621	0.1	-0.1	0.0	0.0
A1	3223028	2619	0.4	0.4	0.0	-0.2
A1	3223028	2617	0.1	0.0	0.1	-0.2
A1	3223028	2615	0.0	0.0	0.0	0.1
A1	3223028	2613	1.3	-1.2	0.5	0.1
A1	3223028	2611	0.4	0.4	0.1	0.1

Figure 6-5

6.5 Plots

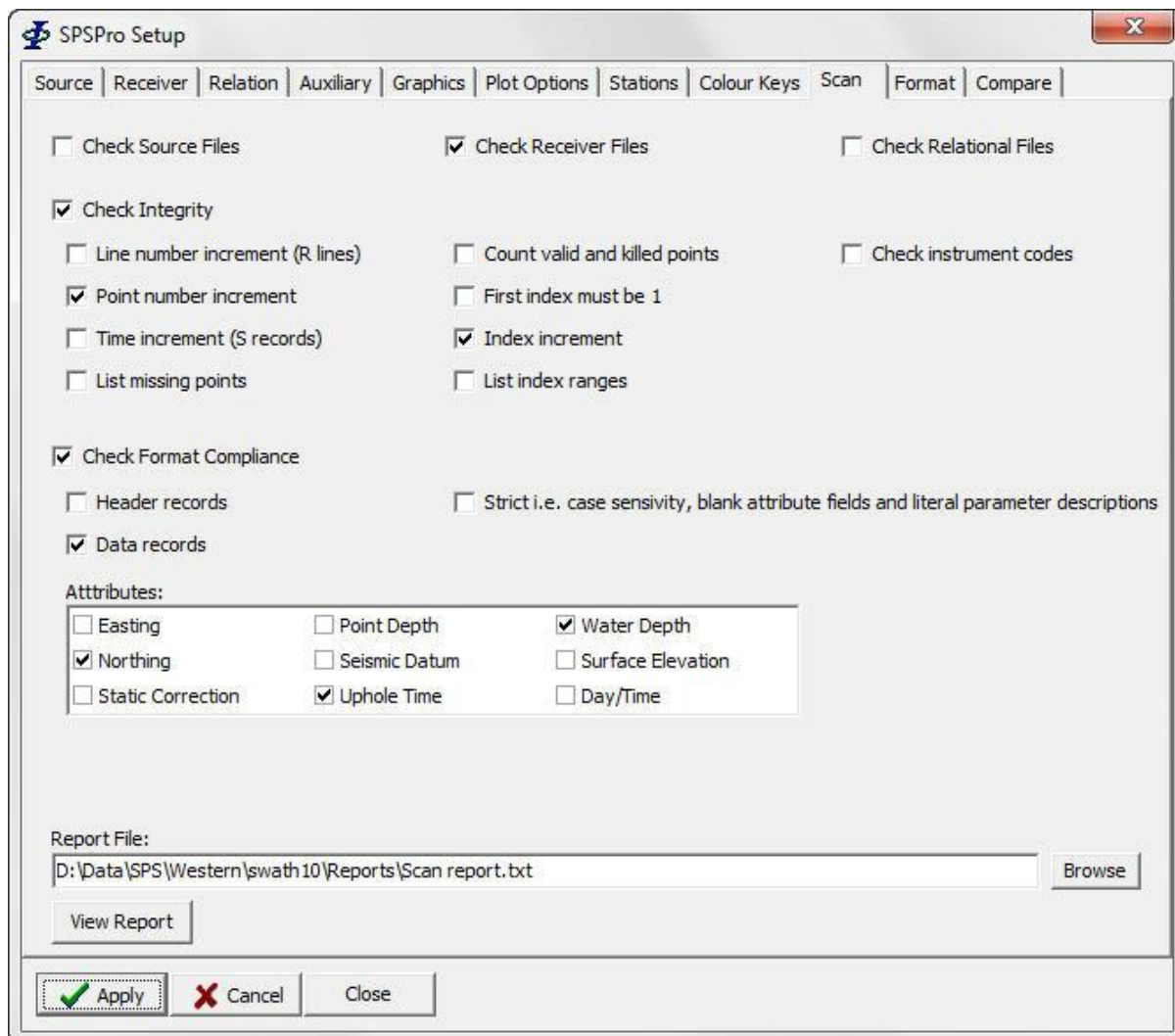
Click the *Plot* button to display times series plots of all the comparisons computed. These plots are no longer available after the Plot module is closed.

Refer to the section Multiplot for a description of the plot module.



7 SCAN

The *Setup | Scan* page, in conjunction with the *Setup | Format* page allows the user to specify the parameters used to check all files in the SPS dataset for integrity and format compliance. See section 2.7 above for the format setup.



The image shows the 'SPSPro Setup' dialog box with the 'Scan' tab selected. The dialog has a title bar with a close button. Below the title bar is a tabbed interface with tabs for Source, Receiver, Relation, Auxiliary, Graphics, Plot Options, Stations, Colour Keys, Scan (selected), Format, and Compare. The 'Scan' tab contains several groups of checkboxes. The first group has 'Check Source Files' (unchecked), 'Check Receiver Files' (checked), and 'Check Relational Files' (unchecked). The second group, 'Check Integrity', has 'Line number increment (R lines)' (unchecked), 'Point number increment' (checked), 'Time increment (S records)' (unchecked), 'List missing points' (unchecked), 'Count valid and killed points' (unchecked), 'First index must be 1' (unchecked), 'Index increment' (checked), and 'List index ranges' (unchecked). The third group, 'Check Format Compliance', has 'Header records' (unchecked), 'Data records' (checked), and 'Strict i.e. case sensitivity, blank attribute fields and literal parameter descriptions' (unchecked). Below these is an 'Attributes' section with a table of checkboxes: Easting (unchecked), Northing (checked), Static Correction (unchecked), Point Depth (unchecked), Seismic Datum (unchecked), Uphole Time (checked), Water Depth (checked), Surface Elevation (unchecked), and Day/Time (unchecked). At the bottom, there is a 'Report File' field with the path 'D:\Data\SPS\Western\swath10\Reports\Scan report.txt' and a 'Browse' button. Below the field is a 'View Report' button. At the very bottom are 'Apply' (with a green checkmark icon), 'Cancel' (with a red X icon), and 'Close' buttons.

SPSPro Setup

Source | Receiver | Relation | Auxiliary | Graphics | Plot Options | Stations | Colour Keys | Scan | Format | Compare

☐ Check Source Files ☒ Check Receiver Files ☐ Check Relational Files

☒ Check Integrity

☐ Line number increment (R lines) ☐ Count valid and killed points ☐ Check instrument codes

☒ Point number increment ☐ First index must be 1

☐ Time increment (S records) ☒ Index increment

☐ List missing points ☐ List index ranges

☒ Check Format Compliance

☐ Header records ☐ Strict i.e. case sensitivity, blank attribute fields and literal parameter descriptions

☒ Data records

Attributes:

☐ Easting	☐ Point Depth	☒ Water Depth
☒ Northing	☐ Seismic Datum	☐ Surface Elevation
☐ Static Correction	☒ Uphole Time	☐ Day/Time

Report File:
D:\Data\SPS\Western\swath10\Reports\Scan report.txt Browse

View Report

☒ Apply ☐ Cancel Close

Figure 7-1

7.1 Setup

Check the file checkboxes at the top of the form to specify which file categories to be included in the scan.

Check all options required. These are explained below.



Specify the patch and name of the report file to which the scan report will be written.

7.2 Integrity Checks

Integrity checks are performed on a line by line basis on the data stored in the database.

<i>Line number increment:</i>	Reports exceptions to the receiver line number increment specified under <i>Setup Format</i> .
<i>Point number increment:</i>	Reports exceptions to the receiver and shot number increments as specified under <i>Setup Format</i> .
<i>Time increment:</i>	Shot records must be sorted by time. This option reports records in source files for which the shot time decrements.
<i>List missing points:</i>	Lists all missing points based upon the shot and receiver number increments specified under <i>Setup Format</i> .
<i>Count valid and killed points:</i>	Reports the number of killed and not killed points. A killed point is defined as having the instrument code "KL".
<i>First index must be 1:</i>	Reports exceptions where the first index of a point is greater than 1.
<i>Index increment:</i>	Reports records for which the increment in index for the same point ID is greater than 1.
<i>List index ranges:</i>	Lists the point ranges for each index found in the line.
<i>Check instrument codes:</i>	Reports records for which the instrument code does not appear in the header. Do not enable this option if there is no file header.

7.3 Format Compliance

<i>Check Header Records:</i>	Include header records i.e. all records starting with 'H' when checking format compliance.
<i>Check Data Records:</i>	Include data records i.e. all records starting with 'S', 'R' or 'X' when checking format compliance.
<i>Strict Format Checking:</i>	Case sensitive checking is performed for string literals in the header record descriptions.

All exceptions to the above checks are reported in the report file specified in *Setup | Files | Scan Report File*. This file is displayed on completion of the scan.



8 DATABASE

The Database module provides the means to organize, browse and edit the SPS dataset. From the main menu click on the *Database* button.

Data is organised in a tree with five main branches:

- Header
- Source
- Receiver
- Relation
- Auxiliary



8.1 Header

Click on the *Header* branch to display the header records as shown in Figure 8-1 below.

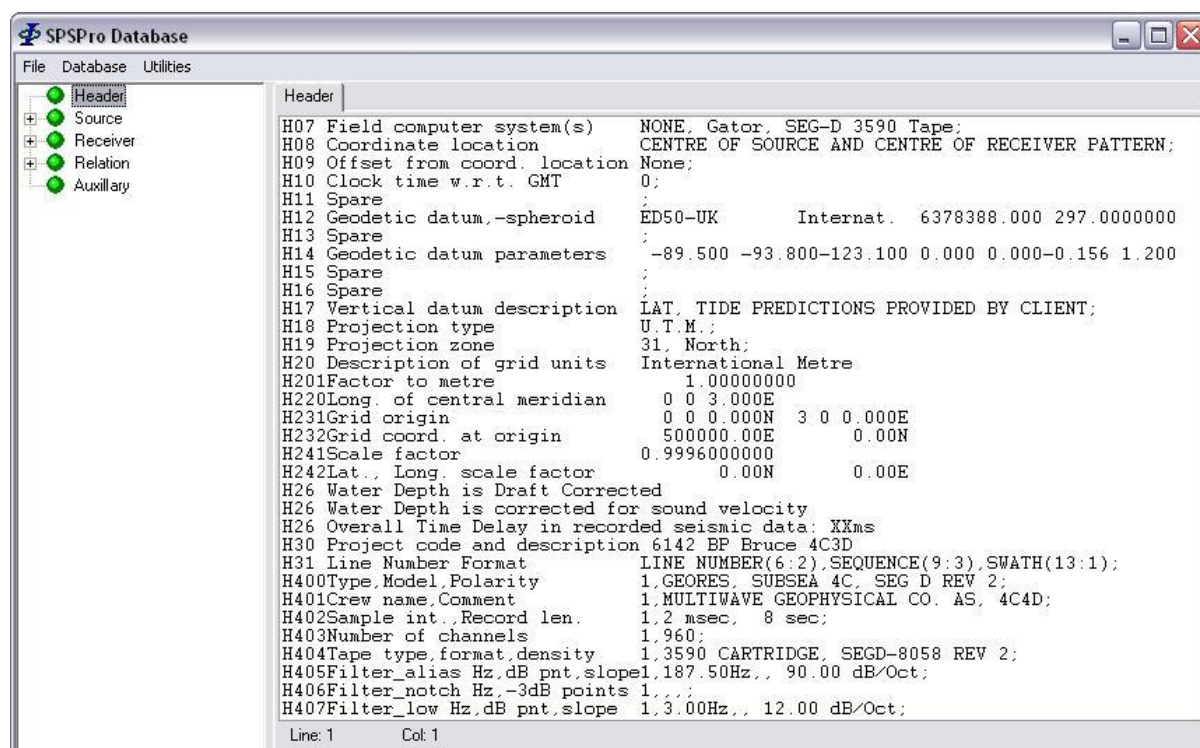


Figure 8-1

The header is the first header read in the whole SPS dataset. It may be edited and saved to all SPS files in the project by choosing from the menu *File A Save*.

The header may be saved to a separate file by choosing *File | Save As* from the menu.



8.2 Data

The SPS dataset is subdivided by *Type*, i.e. source, receiver and relation, *File* and *Line*, represented in the tree by level 1, level 2 and level 3 branches respectively, as shown in Figure 8-1 above.

To display attributes of the main data types click on the relevant level 1 branch. In the right panel the folder, number of files and number of lines are displayed.

8.2.1 Files

To display file data click on any level 2 branch, as highlighted in Figure 8-2 below.

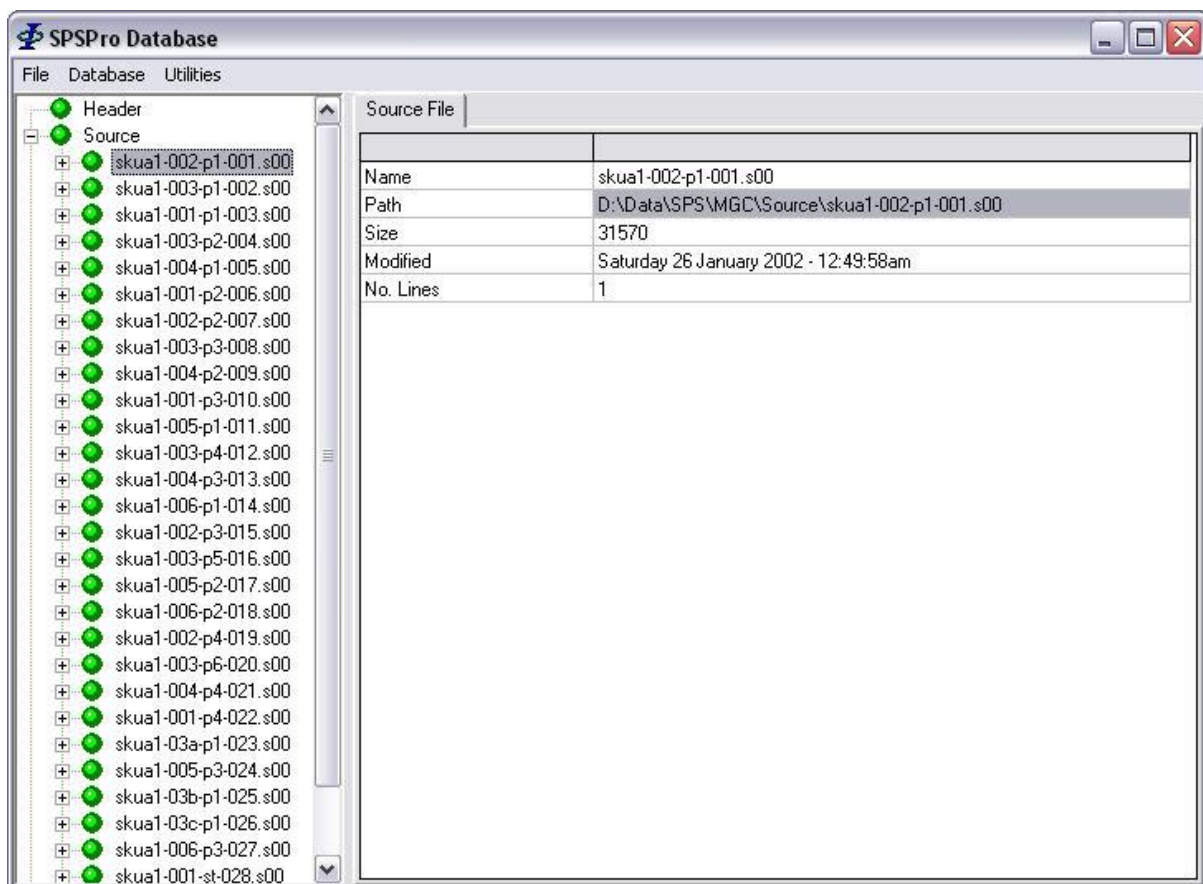


Figure 8-2

The attributes applicable to the file are displayed in the panel on the right. None of these attributes can be edited.



8.2.1.1 Creating Files

To create a new file into which existing lines may be copied, from the menu choose *File | New*, then select from the sub-menu which type of file to create: source, receiver or relation.

8.2.1.2 Renaming Files

To rename a file click twice on the branch label or press <F2>, type in the new name and press <Enter>.

8.2.2 Copying Lines

To copy an existing line to a file, highlight the required line branches and using the left mouse button drag them onto the destination file as shown in Figure 8-3 below.

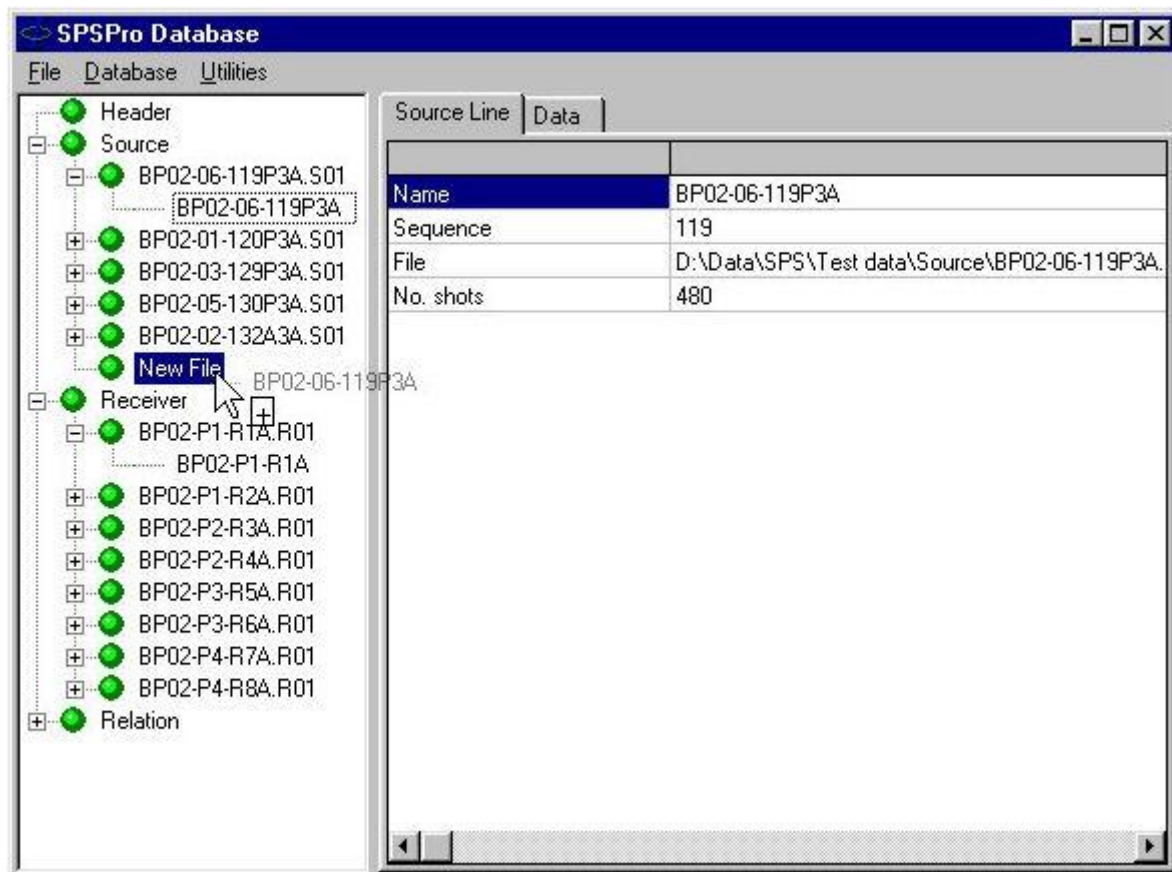


Figure 8-3

Lines cannot be copied to files of a different data type.

The file and data type icons change to red to indicate that the file has been edited.



8.2.3 Deleting Lines

To remove a line from the database, from the menu choose *Database | Delete Lines*.

The file and data type icons change to red to indicate that the file has been edited.

8.2.4 Line Data

Each file is subdivided into the individual lines found within that file which are represented by level 3 branches as highlighted in Figure 8-4 below.

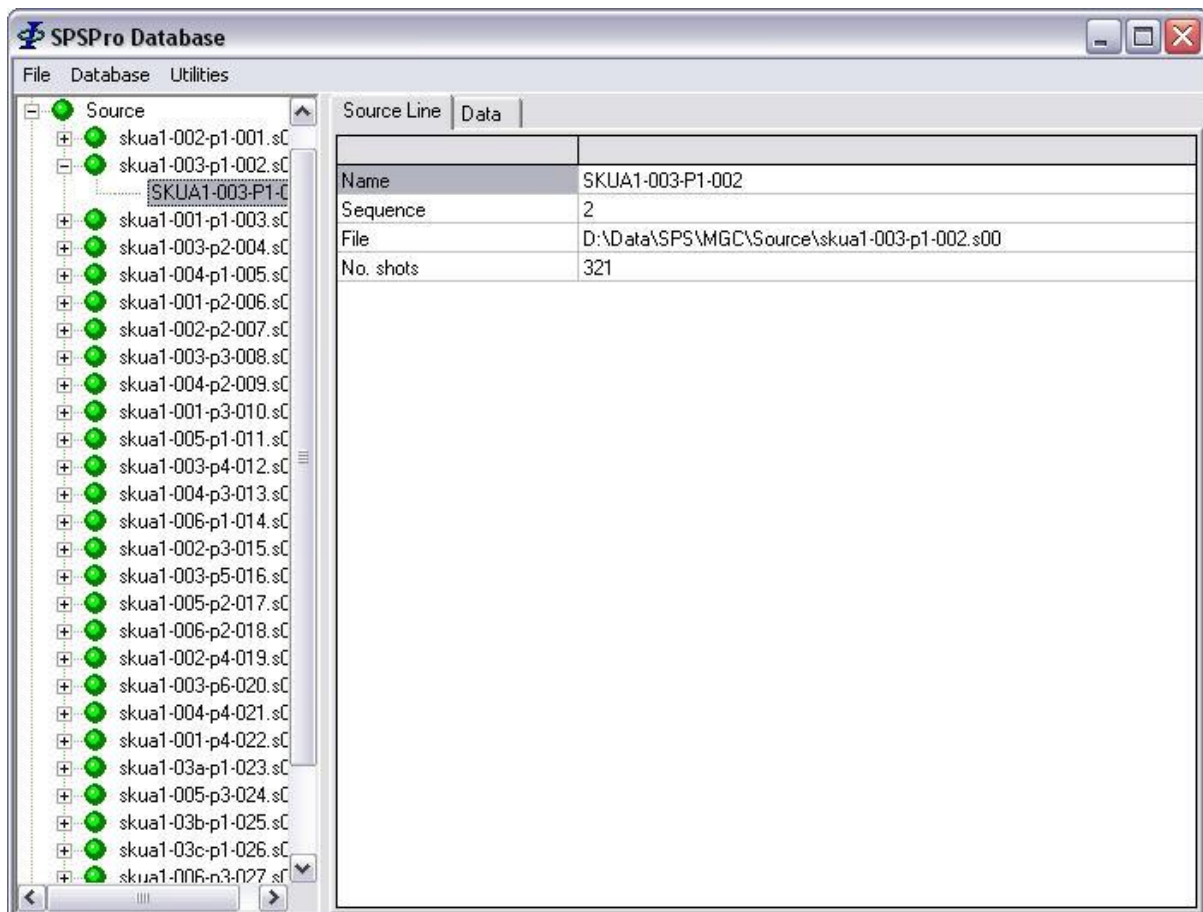


Figure 8-4

8.2.4.1 SPS Records

The individual records in the file for the selected line are displayed in the *Data* tab page in the panel on the right, as shown in Figure 8-5 below.



The attributes applicable to the line are displayed in the *Line* tab page in the panel on the right. Of these only the line name may be edited.

All record attributes may be edited by typing in the new value.

A search and replace facility is available. From the menu choose *Utilities | Search*.

SP	Code	Index	Julian Day	Time	Easting	North
1001	A1	1	3	00:08:46	603718.5	63401
1002	A1	1	3	00:08:57	603700.4	63401
1003	A1	1	3	00:09:07	603683.2	63401
1004	A1	1	3	00:09:19	603663.4	63401
1005	A1	1	3	00:09:30	603645.0	63401
1006	A1	1	3	00:09:42	603627.1	63401
1007	A1	1	3	00:09:53	603608.2	63401
1008	A1	1	3	00:10:04	603589.3	63401
1009	A1	1	3	00:10:16	603571.4	63401
1010	A1	1	3	00:10:27	603553.7	63401
1011	A1	1	3	00:10:39	603535.5	63411
1012	A1	1	3	00:10:51	603516.9	63411
1013	A1	1	3	00:11:03	603497.9	63411
1014	A1	1	3	00:11:15	603479.8	63411
1015	A1	1	3	00:11:26	603461.6	63411
1016	A1	1	3	00:11:37	603443.0	63411
1017	A1	1	3	00:11:49	603425.0	63411
1018	A1	1	3	00:12:01	603406.3	63411
1019	A1	1	3	00:12:13	603386.3	63411
1020	A1	1	3	00:12:25	603366.8	63411
1021	A1	1	3	00:12:36	603348.7	63411
1022	A1	1	3	00:12:48	603329.8	63411
1023	A1	1	3	00:13:00	603310.8	63411
1024	A1	1	3	00:13:12	603290.3	63411
1025	A1	1	3	00:13:24	603271.2	63411

Figure 8-5

8.2.5 Editing Data

8.2.5.1 Editing

To enter edit mode in a cell click twice in the cell, or press <F2>. The cursor appears and the cell contents may be edited.

To exit edit mode either press <Enter> or click on a different cell.



8.2.5.2 Deleting

Records (entire rows) may be deleted by first highlighting at least one cell of each record to be deleted, then from the menu choosing *Database | Delete Records*.

8.2.5.3 Copying and Pasting Data

To copy selected cells of data to the clipboard highlight the cells with the mouse, or by using the shift and cursor keys, right click and from the popup menu select *Copy*. Key combinations <Ctrl> + <Insert> and <Ctrl> + C may also be used to copy the selection to the clipboard.

To highlight the whole column, just click on the column header.

To paste data from the clipboard highlight the cells into which the data is to be pasted, right click, and from the popup menu select one of the paste functions. All but the first of these functions are numeric. These are:

Replace: Replaces the data in the cell with the data in the clipboard. Key combinations <Shift> + <Insert> and <Ctrl> + V may also be used to paste the contents of the clipboard.

Add: Adds the value of the data in the clipboard to that in the cell.

Subtract: Subtracts the value of the data in the clipboard from that in the cell.

Multiply: Multiplies the data in the cell by the value of the data in the clipboard.

Divide: Divides the data in the cell by the value of the data in the clipboard. If the value of the data in the clipboard is zero then no action takes place.

ie	Water Depth	Surface Elev.
	27.600	0.200
	27.600	0.200
	27.600	0.200
	27.600	0.200
	27.600	0.200
	27.600	0.200
	27.600	0.200
	27.500	0.200
	27.500	0.200
	27.500	0.200

Figure 8-6a

ie	Water Depth	Surface Elev.
	27.600	0.200
	27.600	0.200
	27.600	0.200
	27.600	0.200
	27.600	0.200
	27.600	0.200
	27.600	0.200
	27.500	0.200
	27.500	0.200
	27.500	0.200

Figure 8-6b

Figure 8-6

If the paste selection is greater than the copied selection then only the number of cells



copied will be pasted. In the example shown in Figure 8-6 the top three water depth values will have 0.2 added to them.

It is possible to copy and paste to and from external applications e.g. spreadsheets and text files with carriage return/line feed.

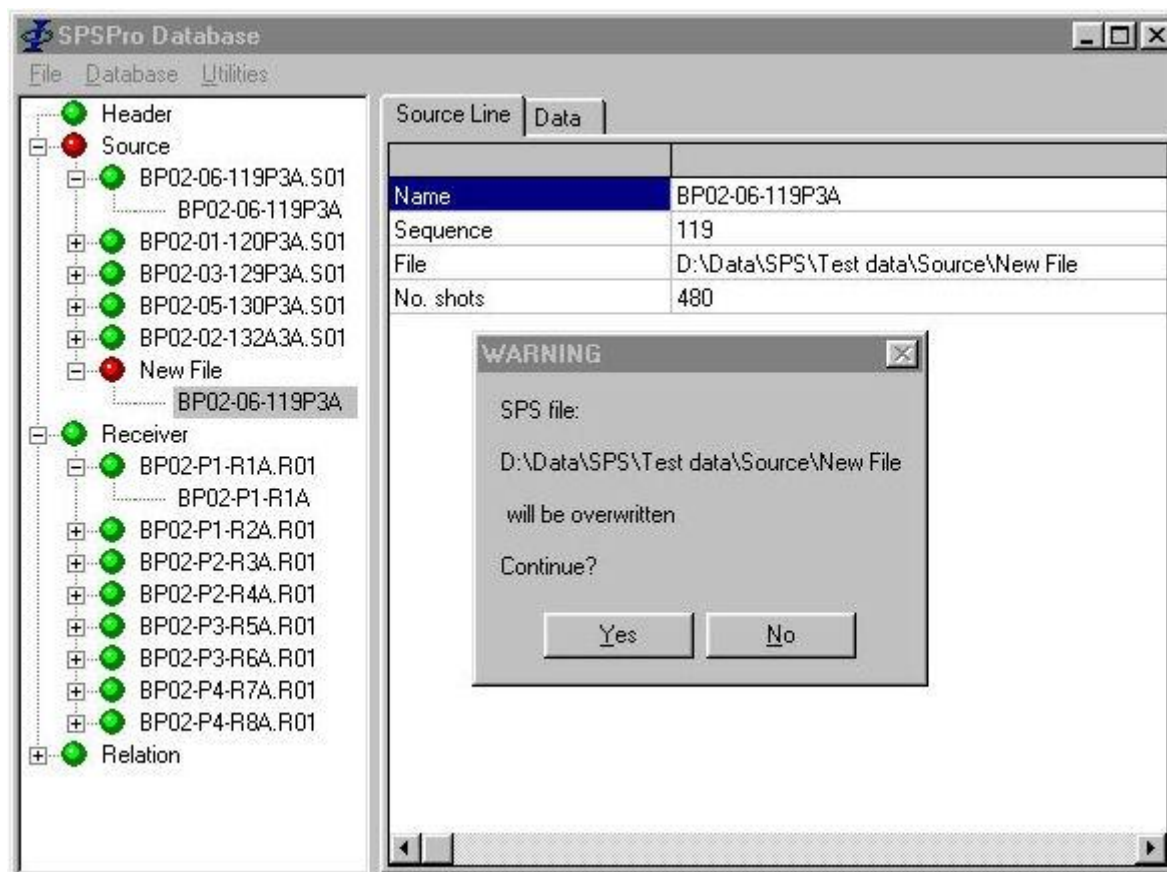
8.2.5.4 Saving Edits

When edits are made to the table, including deletion of records, they are not put into effect until changes are saved to the database by choosing from the menu *Database | Save Line*. Once the database has been saved after any changes have been made, these changes are immediately made available to all other SPSPro program features such as the *Map Display*.

At the same time, the *File* and *Data Type* branch icons turn red to indicate that the database is now different from the file on disk.

These changes are only saved to the file on disk when the file is saved.

Warning: Once the file has been saved the changes are not reversible. It is advisable that backups are made to all original SPS files before selecting them for use in the project.

**Figure 8-7**

8.2.5.5 Undoing Edits

For files which have not been saved, i.e. those whose branch icons are red, all edits which have been made may be undone by choosing from the menu *Database | Undo All Edits*.

8.3 Interpolating Receivers

This function is used to interpolate receivers in situations where only certain receiver positions have been computed at regular intervals. For example every 5th receiver may have been computed using an acoustic positioning system and it is required to interpolate the receivers between the existing ones.

The SPS receiver file should contain only the computed receivers, for example as shown in Figure 8-8 and Figure 8-9.



Station	Code	Index	Julian Day	Time	Easting	Northing
1275		1	0	00:00:00	537206.4	409490.2
1280		1	0	00:00:00	537158.6	409535.8
1285		1	0	00:00:00	537098.6	409617.2
1290		1	0	00:00:00	537037.3	409695.7
1295		1	0	00:00:00	536973.8	409771.6
1300		1	0	00:00:00	536911.6	409850.5
1305		1	0	00:00:00	536847.8	409930.8
1310		1	0	00:00:00	536790.0	410010.6
1315		1	0	00:00:00	536728.8	410093.2
1320		1	0	00:00:00	536668.8	410168.9
1325		1	0	00:00:00	536607.6	410249.3
1330		1	0	00:00:00	536556.6	410324.1

Figure 8-8**Figure 8-9**

From the menu select *Utilities | Interpolate Receivers*. Enter the required receiver number interval – for the above example to interpolate four new receivers between existing ones enter 1.



The new receivers are linearly interpolated between the existing receivers. The same example after interpolation is shown in Figure 8-10.

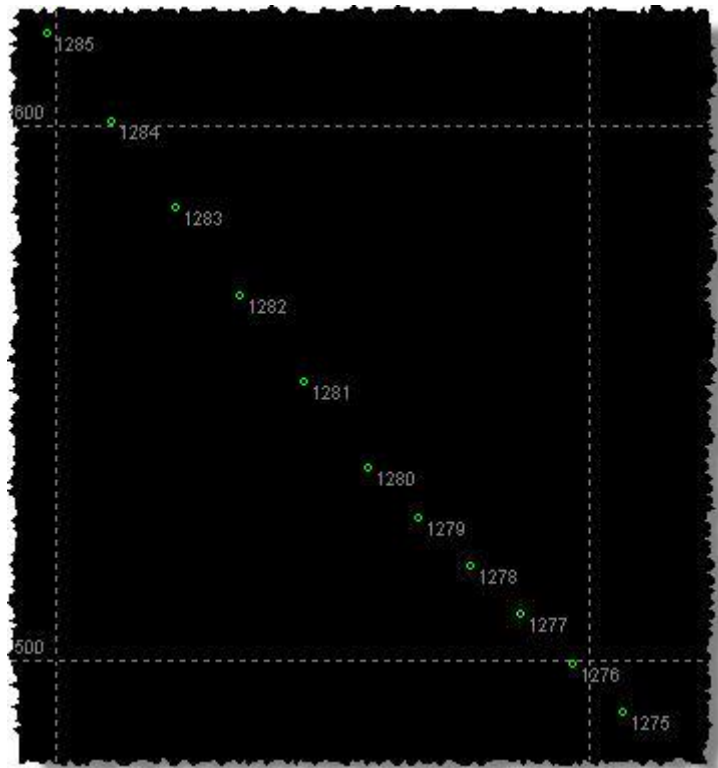


Figure 8-10

8.4 Interpolating Killed Receivers

This function is provided to interpolate receivers for which the computed position has been deemed unacceptable. These receiver should have the instrument code "KL" (not case sensitive).

From the menu select *Utilities | Interpolate Killed Receivers*. All killed receivers will be linearly interpolate between the nearest "good" receivers either side.

Note: no extrapolation is carried out and therefore the first and last receivers in the line cannot be interpolated.

8.5 Interpolating Receiver Depths

To interpolated receiver depths from source depths select from the menu *Utilities | Interpolate receiver depths from source depths*.

Enter the search radius. This is the distance from each receiver within which all source



locations will be used. The specification of this parameter would depend upon the density and distribution of source locations and the seabed topography.

A linear interpolation will be carried out, using data from each source location within the search radius, weighted according to the inverse of the square of the distance from the receiver location.

8.6 Importing Data

External ascii data can be imported into any of the following columns:

Static correction
Point depth
Seismic datum
Uphole time
Water depth
Surface elevation

To import external data first in the tree list highlight the lines into which the data is to be imported. Then from the menu select *Utilities | Import Data*. The External Data dialog appears, an example of which is shown below in Figure 8-11. When the parameters are correctly set up click the *OK* button.



External Data

File:

Data:

78	00:00:20	0001.10	1181
78	00:01:26	0002.75	1183
78	00:02:53	0003.18	1185
78	00:04:19	0004.45	1187
78	00:05:46	0005.91	1189
78	00:07:12	0006.37	1191
78	00:08:38	0007.70	1193
78	00:10:05	0008.91	1195
78	00:11:31	0009.38	1197
78	00:12:58	0010.19	1199

Format:

☒ Fixed Width ☐ Delimited

Search Key:
☐ Time ☒ Station/shot ID

Attribute: Operation:

Figure 8-11

8.6.1 Format

The external data field format can be fixed width or de-limited. Each record must be terminated by a carriage return/line feed.

The format is defined by entering a format definition string in the *Format* field using the following convention:

d = Julian day h = hour
m = minute s = second
i = station/shot id x = data value
any other character = do not import field

Fixed width:
format characters must match exact file positions



e.g.
data: 2001 306 6:24:09.3 294.5
format: yyyy ddd hh mm ssss xxxxx

Delimited:
only one character is used to represent a field,
field delimiter character(s) must be provided

e.g.
data: 2001,306,16,24,9.3,294.5
format: ydhmsx
field delimiter: ,

8.6.2 Synchronisation

The external data is synchronised with the SPS records either by time or station/shot ID. One of these must be therefore present in the external data records. Both can be present but only that selected as the *Search Key* will be used, and the appropriate field should be defined in the format string.

8.6.2.1 Time

The *Search Key* must be set to *Time*.

The external data records must be in chronological order.

The time for each SPS record must fall within the time range of the external data otherwise no data will be imported for that record and an entry will be made to the error log.

If the SPS record time does not match exactly an external data record time then the imported attribute value will be linearly interpolated.

8.6.2.2 Station or Shot ID

The *Search Key* must be set to *Station/shot ID*.

For each SPS record the program searches the external data file from the last used record for a matching ID number. If no match is found then all remaining SPS records will be unchanged and an entry for each record made in the error log.

In the following two examples all SPS records will be matched:

External file ID	SPS file1 ID	SPS file 2 ID
1	1	2
2	2	2
3	3	4



4	4	4
5	5	6
6	6	6
7	7	8
8	8	8
9	9	10

In the following example only the first SPS record will be matched:

External file ID	SPS file1 ID
1	1
3	2
5	3
7	4
9	5
11	6
13	7
15	8
17	9



8.7 Exporting Data

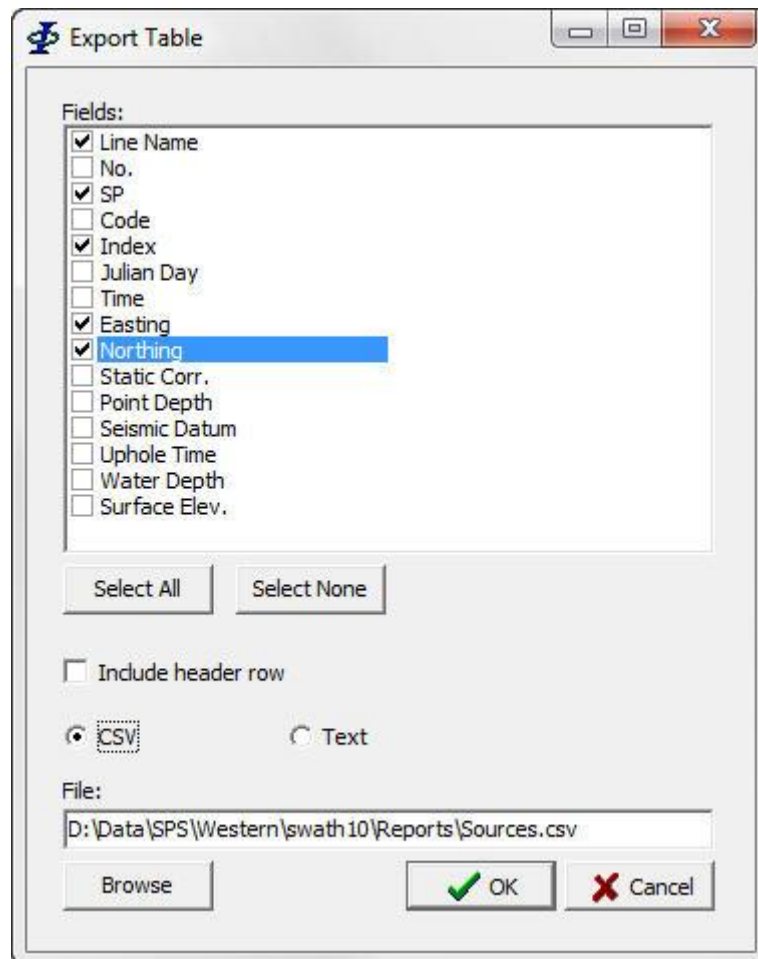


Figure 8-12

Selected attributes from the currently displayed table for all selected lines can be exported to CSV or text file by selecting from the menu *Utilities | Export Data*.

Highlight all lines in the tree display from which data is to be exported.

Check the fields which are to be exported.

Specify whether or not to include the header row.

Specify the file type.

Click *OK*.



9 MULTILOT

The multiplot module is the basic interactive time series plotting interface used throughout all FGPS software. Most features are common to all client modules although these modules may support various additional features specific to their application.

This section covers only the common Multiplot features used by all client modules.

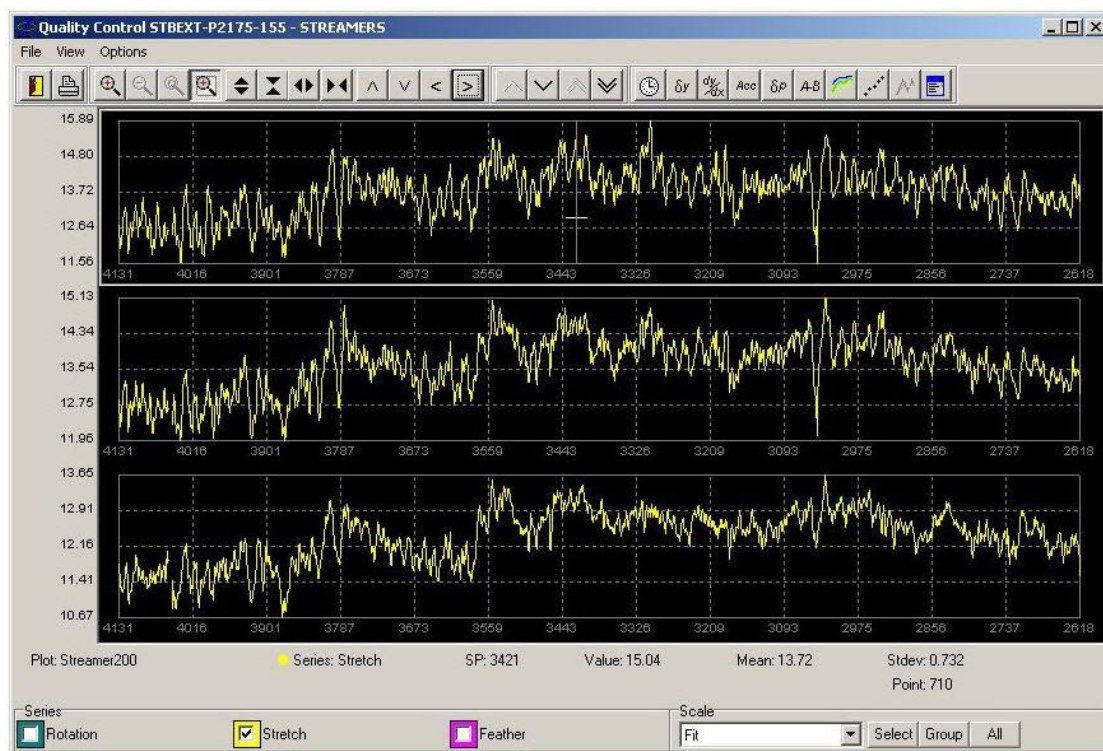


Figure 9-1



9.1 Menu

File:

- Print Current:** Prints the *active plot* as it appears on the screen on one full page using the current printer settings.
- Print:** Allows selection of multiple plots as shown in figure 15.2. Plots will be printed as seen on the screen.
- Printer Setup:** Invokes the Windows printer setup dialogue box.
- Save Selected Plot Bitmap:** Displays the Save File dialogue box. Saves the *Selected Plot* to a bitmap file.
- Save Form Bitmap:** Displays the Save File dialogue box. Saves the form to a bitmap file.
- Exit:** Exits the Precondition module and writes all data to the database if any changes have been made.

View:

- Zoom Factor:** Allows the default horizontal zoom factor to be changed. The default is 2:1
- Grid Lines:** Toggles grid lines on or off.
- Plots per Screen:** Allows the number of visible plots to be changed to any number between 1 and 10 inclusive.
- Colour:** Allows changing the colours of the individual plot series, interpolated values, edit line, nominal line and cursor lines.
- Cursor:** Allows the horizontal and vertical cursors to be toggled on or off. The default is vertical on, horizontal off.
- List:** Displays the list of all plots. The *Active Plot* is highlighted in the list and can be changed by clicking an item on the list.
- Network:** Displays the Network Diagram.

Options:

- Load Palette:** Loads a previously saved palette defining the plotting, edit and cursor colours.
- Save Palette:** Saves the current plotting, edit and cursor colours.
- Hotkeys:** Set the Hotkeys for deleting data using the edit line. Ctrl and Alt key combinations are not supported.
-



9.2 Toolbar



Exits the Precondition module and writes all data to the database if any changes have been made.



Prints the *Selected Plot* as it appears on the screen on one full page using the current printer settings.



Expand the horizontal axis of all plots by the current zoom factor.



Contract the horizontal axis of all plots by the current zoom factor.



Fit the horizontal axis of all plots to the window.



When depressed enables the cursor to be used to zoom into any area of a plot. When up (default) enables the cursor to be used to draw an edit line on a plot.



Expands the vertical scale of the *Selected Plot* by two.



Contracts the vertical scale of the *Selected Plot* by two.



Expands the horizontal scale of the *Selected Plot* by two.



Contracts the horizontal scale of the *Selected Plot* by two.



Pans the *Selected Plot* up by one 20th of the vertical range.



Pans the *Selected Plot* down by one 20th of the vertical range.



Pans the *Selected Plot* left by half the horizontal range.



Pans the *Selected Plot* right by half the horizontal range.



Decrements the *Selected Plot* by one.



Increments the *Selected Plot* by one.



Displays the previous page according to the number of visible plots.



Displays the next page according to the number of visible plots.



Toggles the x-axis between shotpoint (default) and time in seconds from the first shot.



Toggles all plots between normal and point to point difference.



Toggles all plots between normal and rate of change.



Toggles all plots between normal and acceleration.



Toggles all plots between normal and difference from a least squares polynomial curve of specified order between 1 and 25 fitted through all good points.



Plots the difference between the *Selected Plot* and another plot. A plot list appears from which the comparison plot may be selected. Plotted values are the *Selected Plot* minus the comparison plot.



Overlays data from another plot selected from the list of all plots. Up to 10 overlays can be plotted.



Plots individual data points as a cross.



Plots the nominal value if available.



Displays the list of all plots. The *Selected Plot* is highlighted in the list and can be changed by clicking an item on the list.

9.3 Plots

Up to 10 plots can be displayed in one page. The list of plots can be browsed by scrolling using the toolbar buttons, the cursor and page up and down keys, or by selecting from the plot list.

9.3.1 *Selected Plot*

The *Selected Plot* is highlighted by a white 3D border and is selected by clicking in the plot area with either mouse button. The *Selected Plot* will change when scrolling through the plots or selecting from the plot list. Some of the toolbar functions are specific to the *Selected Plot* (see above).

9.3.2 *Active Plot*

The *Active Plot* is the plot which contains the mouse cursor, or the last plot to have contained the mouse cursor if the mouse cursor is outside the plotting area. When modifying any individual plot using the zooming and panning toolbar buttons the *Active Plot* becomes *Selected Plot*.

The statistics for the *Active Plot* are displayed below the plotting area.

9.4 Series

The available series are displayed in the *Series Panel* located at the bottom left of the window (see figure 15.1). The visibility of each series can be toggled by clicking on the series checkbox.

By default only the first series is displayed when the Multiplot module is instantiated.

9.4.1 *Active Series*

The *Active Series* is indicated by the information immediately below the bottom-most plot.



The statistical information displayed always pertains to the *Active Series*. Toggling on a series causes it to become the *Active Series*. If more than one series are displayed the *Active Series* can be changed by clicking on the series name in the *Series Panel*.

9.5 Scale

The y-axis scale of the plotted series for all plots is determined by the scale selected from the dropdown list in the *Series Panel* located at the bottom right of the window. The following options are available for determining the maximum and minimum value plotted:

- Series name:* Scale by the maximum and minimum value of the selected series.
Fit: Scale to fit the maximum and minimum of all plotted series.
Max/min: Specify a fixed maximum and minimum value.
Mean $\pm$ value: Scale by the mean of the *Active Series* plus and minus a specified value.
Nominal $\pm$ value: Scale by the nominal value of the *Active Series* plus and minus a specified value. This option is only available if nominal values are available.

When selecting one of the last three options above edit boxes appears enabling entry of the specified values.

The default scale is *Fit*.

After selecting the desired scale apply this by clicking one of the buttons adjacent to the scaling option dialog, described below:

- Select:* Applies the specified scaling options to the *Selected* plot only.
Group: Applies the specified scaling options to all plots in the same observation group (applies only to SeisPos Precondition module);
All: Applies the specified scaling options to all plots.

9.6 Zooming

In addition to the zooming functions in the toolbar, mouse wheel scrolling can also be used.

To zoom horizontally hold down the <Ctrl> key and scroll the mouse wheel.

To zoom vertically hold down the <Shift> key and scroll the mouse wheel.

To zoom horizontally and vertically hold down the <Ctrl> and <Shift> key and scroll the mouse wheel.

Scroll up to zoom in and down to zoom out.



The centre of the zoom is the position of the mouse cursor.

9.7 Popup Menu

By clicking the right mouse button on any plot, that plot becomes the *Selected Plot* and a popup menu is invoked with the following functions which apply to the *Selected Plot* only:

<i>Table:</i>	Display a table of data for all series (see below).
<i>Overlay key:</i>	Display the colour key for overlaid plots.
<i>Zoom out:</i>	Zoom out plot to full extent.
<i>Reset:</i>	Revert to normal from comparison or overlay.

9.8 Plot Statistics

Plot statistics pertaining to the *Active Plot* are displayed below the plots as the cursor moves from plot to plot. If the plot is zoomed in then the statistics will pertain only to the visible data:

- Name.
- Mean value.
- Nominal value (if available).
- Standard deviation.
- Number of observations.

The following statistics are displayed for the cursor position:

- Shotpoint number, or if the *Time/shot* button is depressed the time in seconds from the first shot.
- Data point number (first point being 0).
- Value where vertical cursor intersects the plot. With the left mouse button depressed, the value at the cursor centre.

9.9 Data Table

To display a numeric table for the *Active Plot* select *Table* from the popup menu in the plot area.

When changing plotted data using the various display options, the data table currently visible will not be updated. There is, however, no limit to the number of tables which can be simultaneously displayed so, for example, it would be possible to display two tables, one showing time and the other showing shotpoint.



The table can be saved to file in comma or space delimited format by selecting *Save Table to File* from the table's popup menu.
